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ABSTRACT

This is the second part of a two-part teacher's manual for an ISS-based elementary school course in the metric system. Behavioral objectives and student activities are included. Topics include: (1) capacity; (2) calculation of volume and surface area of cylinders and cones; (3) mass; (4) temperature; and (5) metric conversions. (BB)

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ELEMENTARY METRIC CURRICULUM

COMMUNITY SCHOOL DISTRICT # 18

BROOKLYN, NEW YORK

PROJECT T.I.M.E.

(TIMELY IMPLEMENTATION OF METRIC
EDUCATION)

NEW YORK STATE EDUCATION DEPARTMENT

E.S.A.A. TITLE 4C GRANT # 42-C77- L3L34 - 2 - DEV.

PART II

**Office of the Community
Superintendent**

Community School District 18
755 East 100 Street
Brooklyn, N. Y. 11238
257-7500

SE 027 739

Use what you have learned.
Work with liters.



- 1 Make lemonade for Lisa's party.



Recipe for Lemonade


= 1 liter when full


lemon juice


cold water


sugar

- 2 How many liters?

A. How much lemon juice?

B. How much sugar?

C. How many liters in all? _



- 3 One liter of lemonade serves 5 children.
How many children can Lisa serve?

- 4 There were 8 boys and 7 girls at the party. How many liters of lemonade were left?



- 5 One liter serves 5. How many liters should be made to serve 50?

ELLIE ELEPHANT



Ellie Elephant lives in India. She needs about 90 ℓ of water a day to drink, and about 180 ℓ of water to pour over herself.

1. A human being needs to drink about 2 ℓ of water each day. Every day Ellie drinks about as much water as _____ human beings need.

2. In all, how much water does Ellie need each day?

_____ ℓ

3. Ellie's baby elephant Albert drinks about 50 ℓ of water each day. About how much drinking water is needed each day for both Ellie and Albert?

_____ ℓ

4. Albert uses about 100 ℓ of water each day for pouring and playing. About how much water is used each day by the two elephants?

_____ ℓ

4.10.12 CAPACITY

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

The student will be able to...

3.10.12

master all I.O.s in the module.

estimate and measure capacity,
in liters, of various shaped containers.

NEW I.O.s

The student will be able to...

4.10.12.01

recognize a milliliter and develop an
understanding of materials that
approximate the volume of a milliliter (ml)

4.10.12.02

identify that there are 1000 ml in one
liter

4.10.12.03

measure the volume of various material
in tens of ml.

4.10.12.04

solve story problems related to the
above I.O.'s.

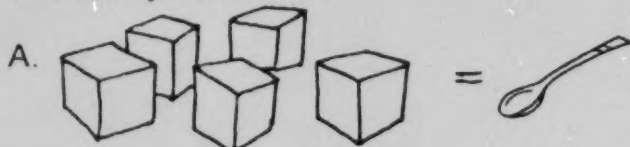


How do cooks use the metric system?

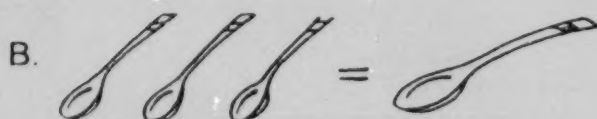
$$1\,000\text{ ml} = 1\text{ l}$$

explore

1 How many milliliters?

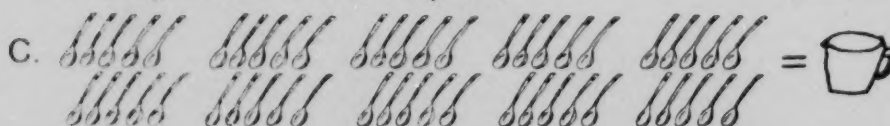


_____ ml = 1 tsp.



3 teaspoons = 1 tablespoon

_____ ml = 1 tbsp.



50 teaspoons = 1 metric cup

_____ ml = 1 cup

2 Use sand, salt, or water. How many ml does each hold?



_____ ml



_____ ml



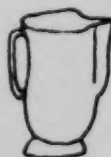
_____ ml

3 How many liters does each hold?



_____ ml

_____ liters



_____ ml

_____ liters

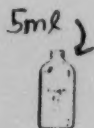
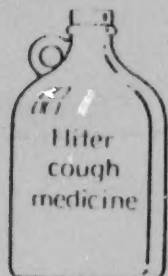


_____ ml

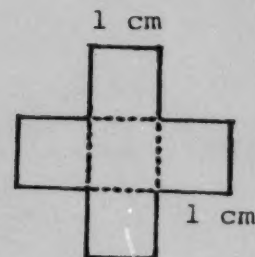
_____ liters

We need a unit smaller than a liter to measure small amounts of liquid.

Is the teaspoon a good unit ?



Make a cube this size.
Leave the top open.
Fold on the dotted lines. Tape the edges.



Fill the cube with sand (or water). If a liter is divided into 1000 equal parts each part would be this amount.

Empty it into a teaspoon. Look at the amount.

This amount is called a

milliliter.

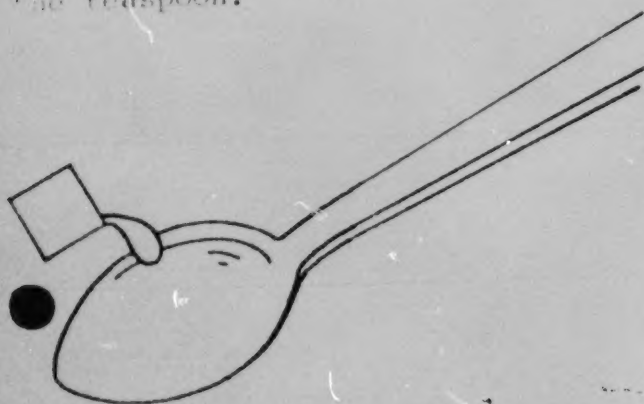
It sounds like millimeter.

Say milliliter !

Use the milliliter measure.

Note that it is a cube with each side 1 cm long.

Estimate how many milliliters will fill the teaspoon.



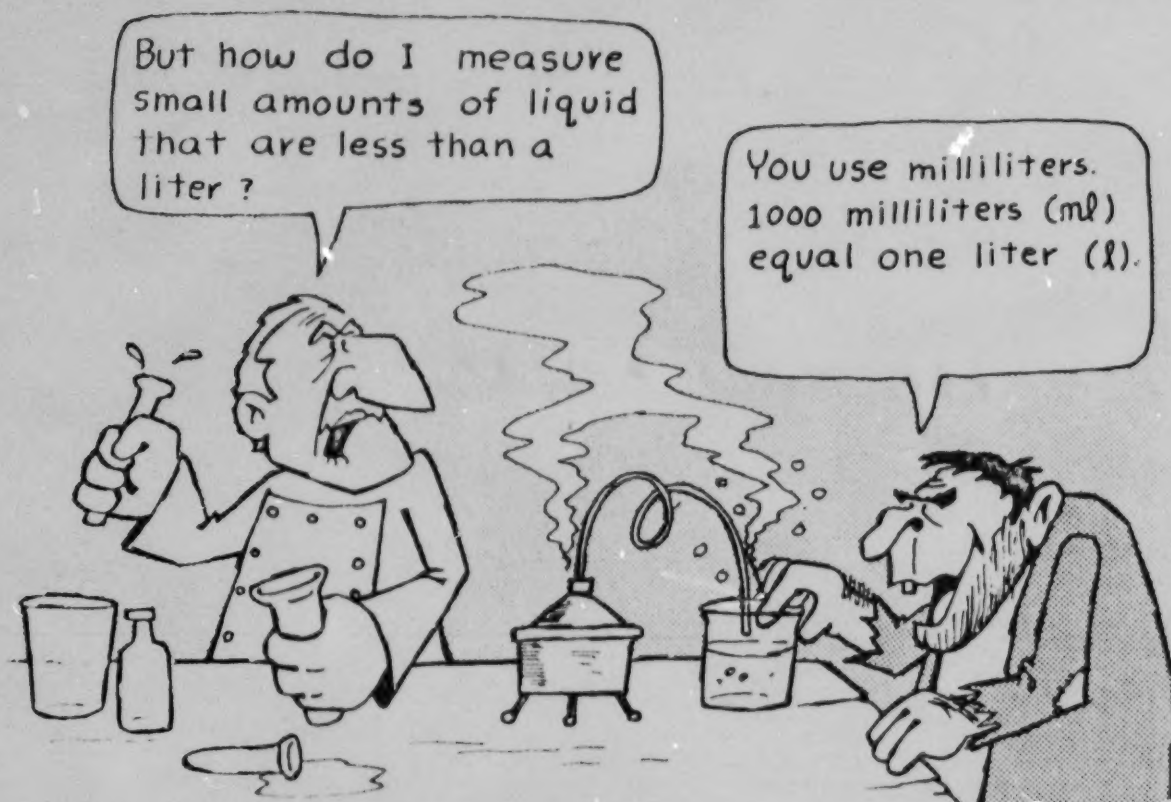
Since milli means 1000 th part of, then milliliter is 1000 th part of a liter.

How many milliliters = 1 liter ?

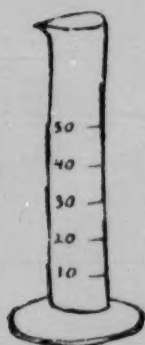
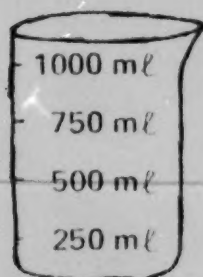
You're right !

Then measure it.

How close did you get ?



Collect some containers that have milliliter measures.



METRIC MUD

125 ml cold water

250 ml corn starch

Mix water and corn starch in a bowl.

Stir the mixture fast. What happened? Write a description.

Hit the surface hard with your hand.

Slowly push your finger into the mixture. Did you touch the bottom both times?

Pull out your finger fast. Write a description of how it felt.

1

Find some containers you estimate hold these amounts:

$\frac{1}{4}$ l , $\frac{1}{2}$ l , $\frac{3}{4}$ l , 250 ml,

500 ml, 100 ml, 200 ml .

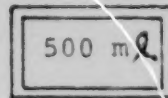
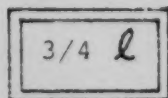
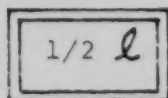
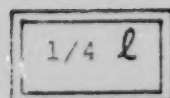
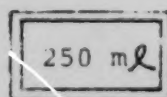
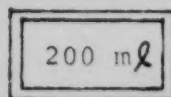
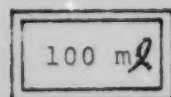
Check your estimate by measuring them with the milliliter container.

2

Have some fun with your partner !

Use the containers you just measured.

Make paper labels for them like this:



Put the labels on the containers.

Ask your partner if the label is right for the container.

If it is not, he must tell you the right label.

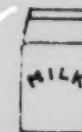
3

Part of a recipe calls for:

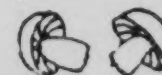
5 ml salt



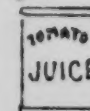
50 ml milk



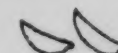
$\frac{1}{2}$ l mushrooms



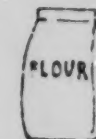
100 ml tomato juice



2 ml garlic



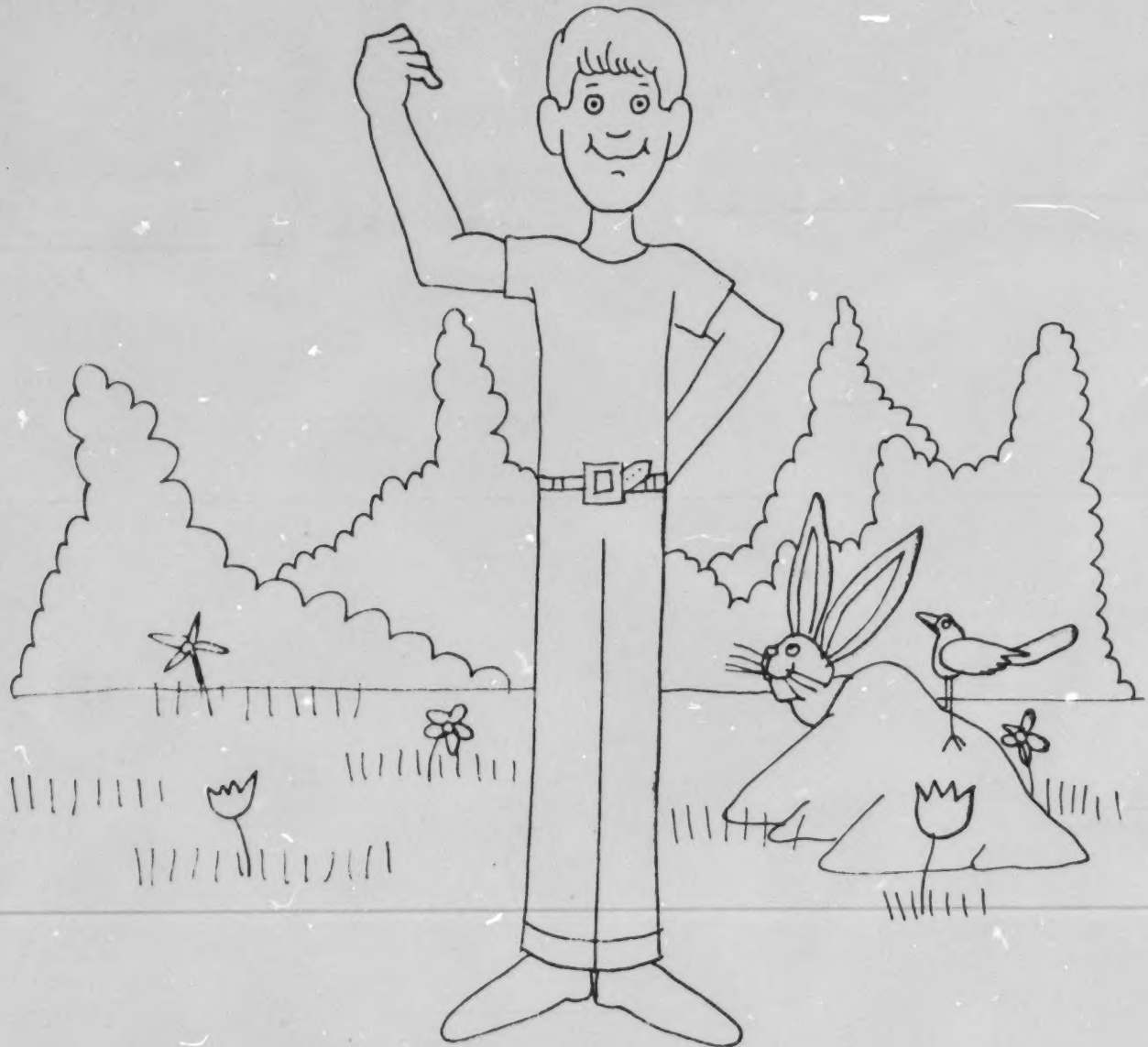
$\frac{1}{4}$ l flour



What is the total volume of this part of the recipe ?

M-22d-

HEALTHY HENRY



Healthy Henry read in his health book that his body loses about 2500 mL of water every day. To stay healthy he must take in about the same amount of water through the liquids he drinks and the food he eats.

1. At breakfast, Healthy Henry drank 150 mL of orange juice, 250 mL of milk, and had 150 mL of milk with his cereal. How many milliliters of liquid did he take in? _____ mL

2. At lunch, Henry drank 2 cartons of milk (about 250 ml each) and ate a bowl of vegetable soup which was about 150 ml of liquid. How much liquid did he take in at lunch?

_____ ml

3. Between meals Henry drank 4 glasses of water, about 225 ml each. On the way home from school he drank a chocolate-vanilla-strawberry ice cream soda which was about 150 ml of liquid. In all, how much liquid did Henry drink that day between meals?

_____ ml



4. How many milliliters of liquid does Henry need in one day?
_____ ml Has Henry already had enough liquid for the day? _____ If not, will a glass of milk (about 250 ml) with dinner give Healthy Henry the total amount of liquid needed for one day? _____

5.10.12 CAPACITY

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

The student will be able to...

4.10.12

master all I.O.'s in the module.

identify that there are 1000 ml
in one liter.

measure the volume of various material in
terms of ml

NEW I.O.s

The student will be able to...

5.10.12.01
(see note)

identify a cubic centimeter (cm^3) as
a cube with dimensions of 1cm x 1cm x 1cm
(length x width x height)

5.10.12.02

identify that the capacity of 1cm^3
is 1 ml.

5.10.12.03

identify that the capacity of 1000 cm^3
is 1000 ml or 1 l.

- 5.10.12.04 add and subtract units of capacity
 (*l* and *ml*) with no regrouping
- 5.10.12.05 add and subtract units of capacity in
 ml (over 1000 *ml*) regrouping into liters
 and milliliters
- 5.10.12.06 add and subtract units of capacity in
 l and *ml* with regrouping
- 5.10.12.07 solve story problems related to the above
 I.O.'s.

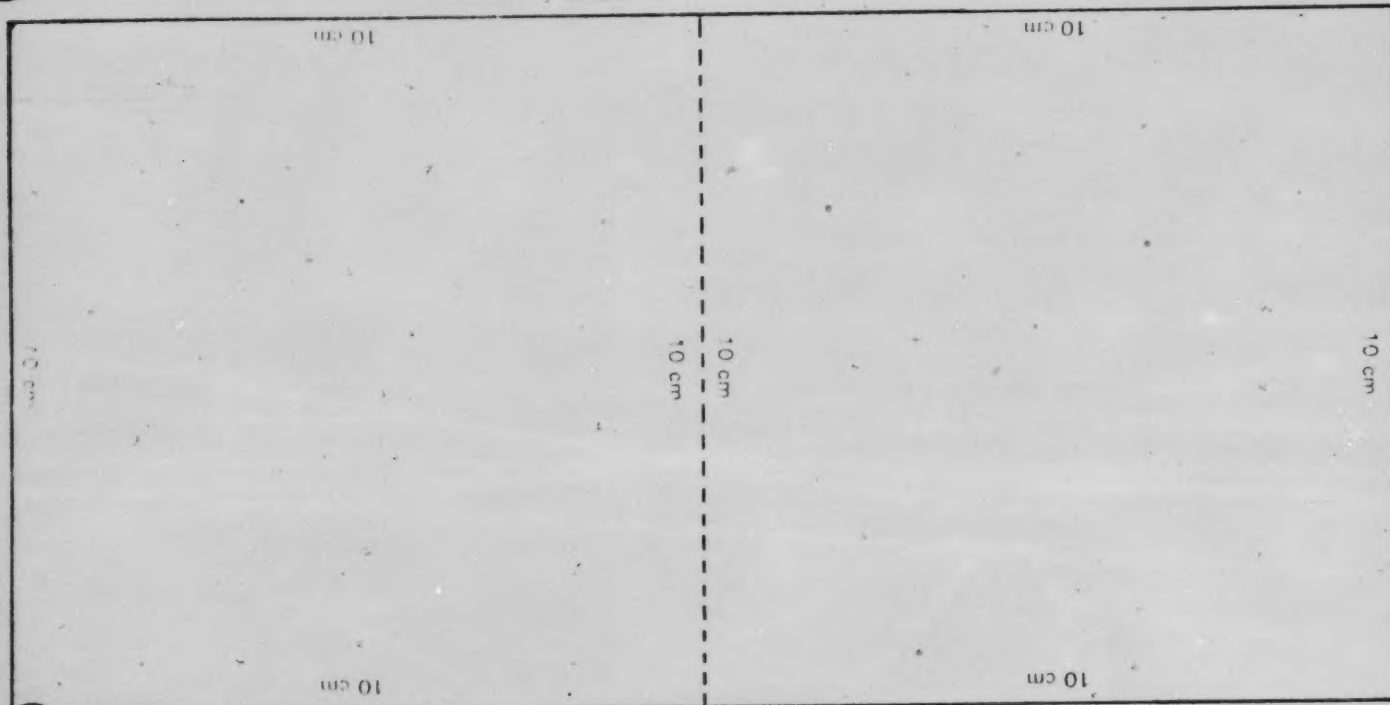
NOTE :

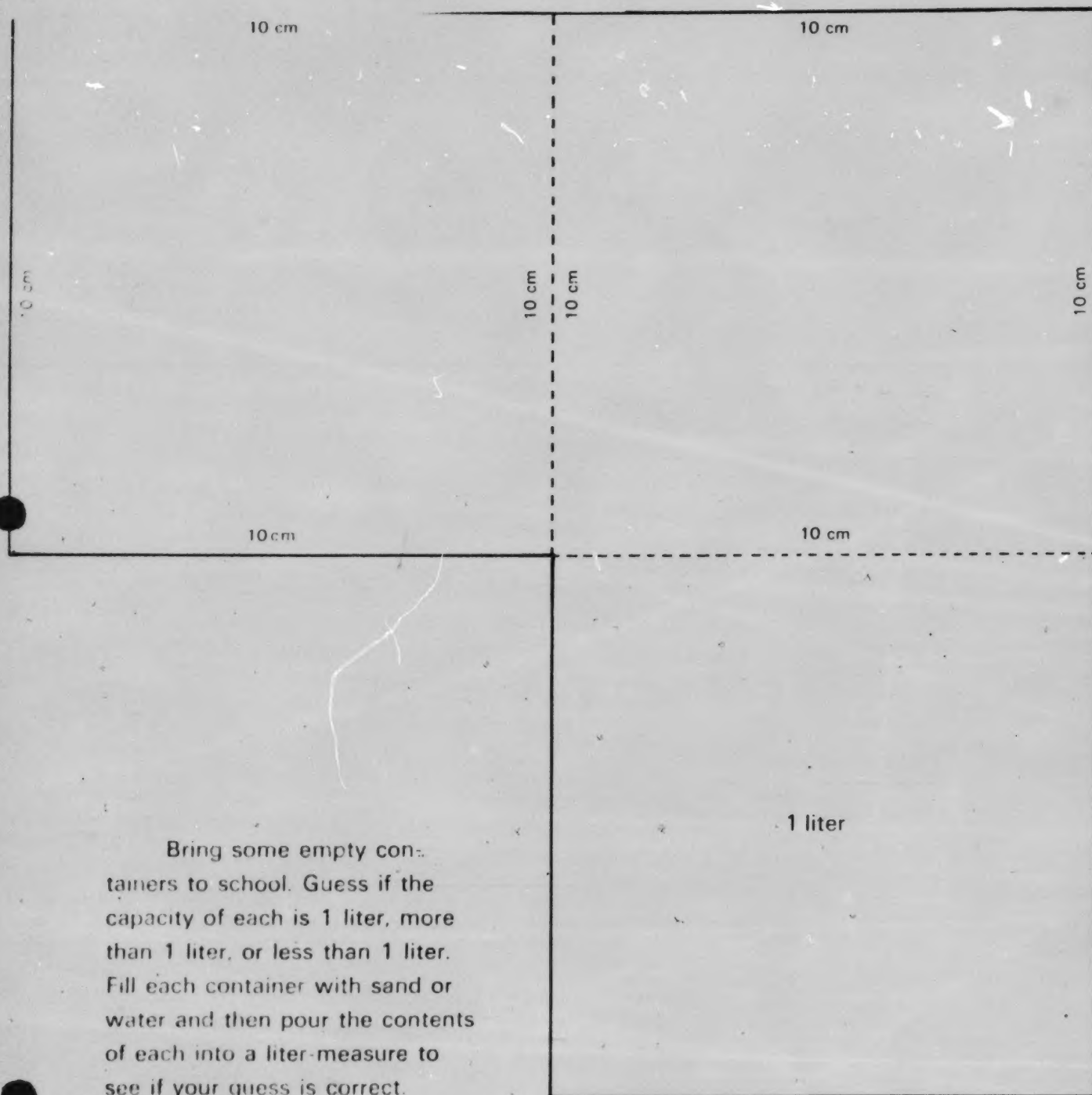
Although cc is a customary abbreviation for cubic centimeter, it is considered slang. The more acceptable abbreviation is cm .

THE LITER

The liter (ℓ) is a unit of measure of capacity that is often used with the Metric System. It is not one of the base units. The liter (sometimes spelled "litre") is used to measure the amount of liquid that things such as bottles, cans, or jars can hold. For example, the liter is used to measure the amount of juice in a bottle or the amount of soup in a can.

The liter is defined as the capacity of a box 10 cm long, 10 cm wide, and 10 cm high. You will have a better idea of a liter if you make a model. Cut out the region at the bottom of this page and the region on page 35. Fold on the dotted lines and tape the regions together to form a box without a top. The capacity of the box you make will be 1 ℓ.





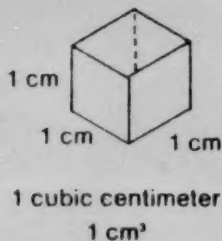
Bring some empty containers to school. Guess if the capacity of each is 1 liter, more than 1 liter, or less than 1 liter. Fill each container with sand or water and then pour the contents of each into a liter-measure to see if your guess is correct.

Work with milliliters.

Capacity can be recorded in milliliters.



explore



1 cm³ holds 20 drops of water.

1 milliliter holds 20 drops of water.

1 cm³ = 1 _____

We write *ml* for _____.

try

What is the capacity of each?



A.

_____ cm³

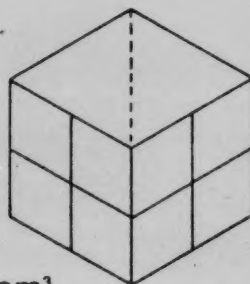
_____ ml



B.

_____ cm³

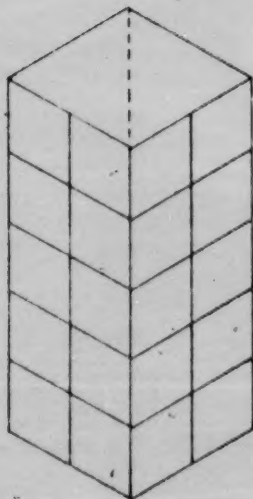
_____ ml



C.

_____ cm³

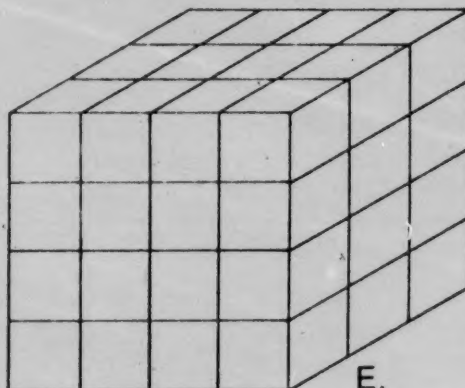
_____ ml



D.

_____ cm³

_____ ml



E.

_____ cm³

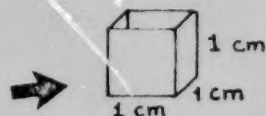
_____ ml

TYING IT ALL TOGETHER

Use the CODE BOX to figure out the missing words.

code box	1 C	7-W	12-H	17-R	22-C
	2-M	8-J	13-T	18-E	23-O
	3-Y	9-V	14-G	19-Q	24-B
	4-L	10-I	15-S	20-D	25-N
	5-X	11-U	16-F	21-P	26-A
	6-K				

A little box this size



would hold exactly one

2-10-4-4-10-4-10-13-18-17 of water. The box is 1 cm long, 1 cm wide, and 1 cm 12-10-14-12. It is called 1 cubic 22-18-25-13-10-2-18-13-18-17 or 1 cm³. The water in the box weighs one 14-17-26-2. So, 1 cubic

centimeter holds 1 ml, and 1 ml of 7-26-13-18-17 weighs 1 gram. (Other liquids do not weigh the same. For example, 1 ml of 2-18-17-22-11-17-3 weighs about 13 grams and 1 ml of 26-4-22-23-12-23-4 weighs about 0.9

gram.) A box this size

would hold 18-5-26-22-13-4-3

1 liter of water. The box

is 10 cm long, 10 cm wide,

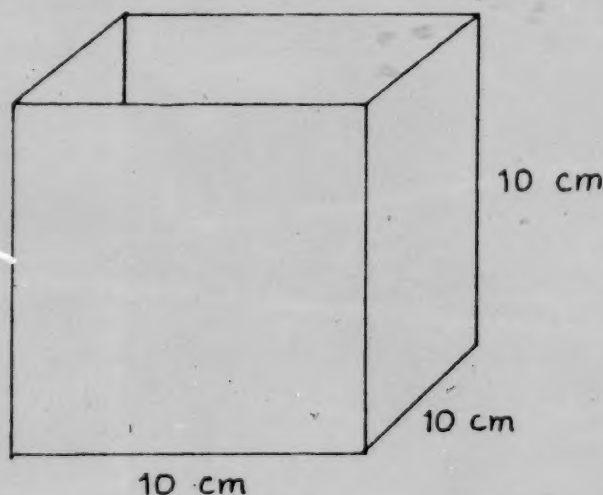
and 10 cm high. It is 1000

22-11-24-10-22 centimeters

or 1000 cm³. Now, 1 cm³ holds

1 ml, so the box holds

1000 ml or one 4-10-13-18-17.



And, 1 ml of 7-26-13-18-17 weighs 1 gram, so the water in the box weighs 1000 grams or one 6-10-4-23-14-17-26-2. If you measured the length, width, and height of an 26-19-11-26-17-10-11-2 in cm, you could find how much water it would hold, and how much the water would 7-18-10-14-12. In the 2-18-13-17-10-22 system, length, 22-26-21-26-22-10-13-3, and weight are all tied together!

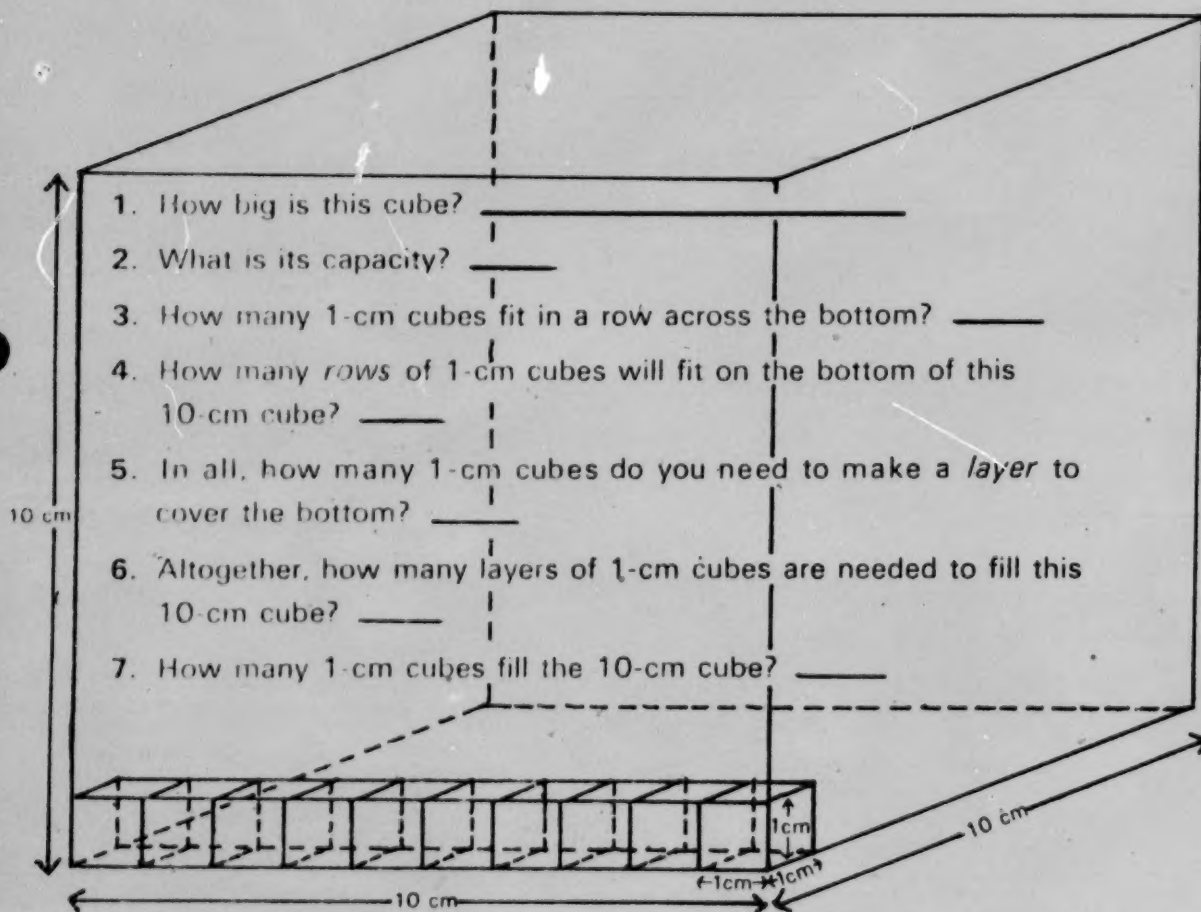
MILLILITER

If a millimeter is 1 of 1000 parts of a meter ($\frac{1}{1000}$ m),
what do you think a milliliter is? _____

That's right! A milliliter (ml) is 1 of 1000 parts of a liter ($\frac{1}{1000}$ l).

$$1 \text{ l} = 1000 \text{ ml}$$

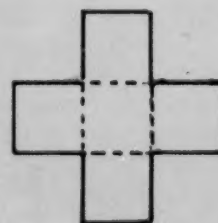
Let's try to find the size of the cube that would have a capacity of 1 ml. Study the diagram below and use it to answer the questions.



Each 1-cm cube is one thousandth of the large cube. Since the 10-cm cube has a capacity of 1 liter, each 1-cm cube has a capacity of 1 milliliter.

Cut out the region at the right and fold it to form a box without a top. The capacity of the box is _____

Twenty drops of water from a medicine dropper will fill the box.

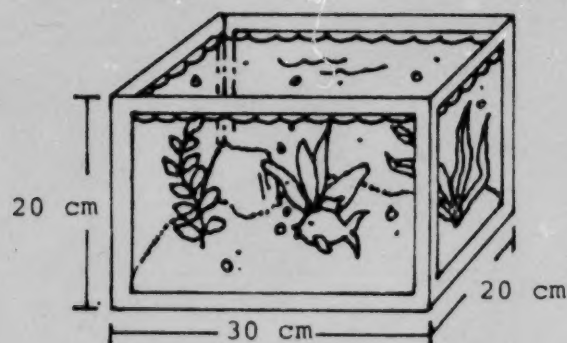


1

$$1000 \text{ ml} = 1 \text{ l}$$

$$1000 \text{ cm}^3 = 1 \text{ l}$$

What is the capacity of this fish tank
in ml? in cm^3 ? in l?



Estimate first, then work out.

Write your answer.

If there is a fish tank in the room,
estimate first, then work out its capacity.

2

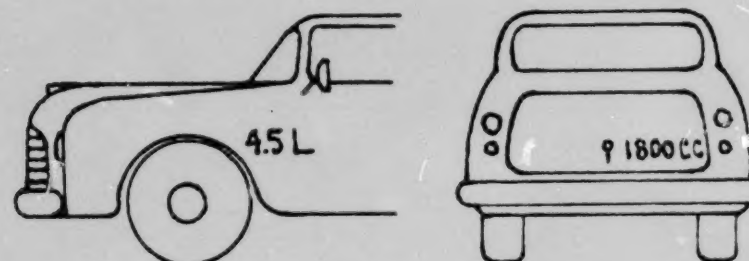
Car engine sizes are measured in cubic
centimeters or in liters.

Larger engines are more powerful.

3.

Find some engine sizes.

Sometimes they are marked on the car.

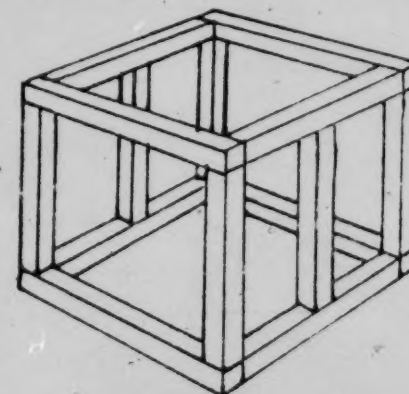


Write the sizes you find.

4.

Make a model of 1000 cubic centimeters,
using only 2 different size Cuisenaire rods.

Measure it to be
sure it is right.



How many of these would go into the fish
tank in activity 1?

21

22

I. Find the answers.

$$\begin{array}{r} 1. \quad 29 \text{ m/} \\ 140 \text{ m/} \\ + 207 \text{ m/} \end{array}$$

$$\begin{array}{r} 2. \quad 500 \text{ m/} \\ 84 \text{ m/} \\ + 112 \text{ m/} \end{array}$$

$$\begin{array}{r} 3. \quad 9 \text{ m/} \\ 460 \text{ m/} \\ + 325 \text{ m/} \end{array}$$

$$\begin{array}{r} 4. \quad 54 \text{ /} \\ + 92 \text{ /} \end{array}$$

$$\begin{array}{r} 5. \quad 184 \text{ /} \\ + 790 \text{ /} \end{array}$$

$$\begin{array}{r} 6. \quad 259 \text{ /} \\ + 96 \text{ /} \end{array}$$

II. Find the answers.

Example 1:

$$\begin{array}{r} 31 \text{ m/} \\ 402 \text{ m/} \\ + 675 \text{ m/} \\ 1108 \text{ m/} \end{array}$$

Example 2:

$$\begin{array}{r} 955 \text{ m/} \\ - 126 \text{ m/} \\ 829 \text{ m/} \end{array}$$

$$\begin{array}{r} 1. \quad 285 \text{ m/} \\ 110 \text{ m/} \\ + 566 \text{ m/} \end{array}$$

$$\begin{array}{r} 2. \quad 400 \text{ m/} \\ 500 \text{ m/} \\ + 600 \text{ m/} \end{array}$$

$$\begin{array}{r} 3. \quad 708 \text{ m/} \\ 219 \text{ m/} \\ + 300 \text{ m/} \end{array}$$

$$\begin{array}{r} 4. \quad 2000 \text{ m/} \\ 413 \text{ m/} \end{array}$$

$$\begin{array}{r} 5. \quad 3964 \text{ m/} \\ - 1234 \text{ m/} \end{array}$$

$$\begin{array}{r} 6. \quad 5050 \text{ m/} \\ - 2197 \text{ m/} \end{array}$$

I.O. 5.10.12.06

Add and subtract. Regroup when necessary.

$$\begin{array}{r} 1) \quad 876 \text{ ml} \\ + 964 \text{ ml} \\ \hline \end{array}$$

$$\begin{array}{r} 2) \quad 684 \text{ ml} \\ + 869 \text{ ml} \\ \hline \end{array}$$

$$\begin{array}{r} 3) \quad 769 \text{ ml} \\ + 695 \text{ ml} \\ \hline \end{array}$$

$$\begin{array}{r} 4) \quad 897 \text{ ml} \\ + 764 \text{ ml} \\ \hline \end{array}$$

$$\begin{array}{r} 5) \quad 642 \text{ ml} \\ 782 \text{ ml} \\ 465 \text{ ml} \\ \hline \end{array}$$

$$\begin{array}{r} 6) \quad 396 \text{ ml} \\ 416 \text{ ml} \\ 978 \text{ ml} \\ \hline \end{array}$$

$$\begin{array}{r} 7) \quad 18 \text{ l} \quad 64 \text{ ml} \\ - 9 \text{ l} \quad 126 \text{ ml} \\ \hline \end{array}$$

$$\begin{array}{r} 8) \quad 26 \text{ l} \quad 5 \text{ ml} \\ - 8 \text{ l} \quad 16 \text{ ml} \\ \hline \end{array}$$

$$\begin{array}{r} 9) \quad 56 \text{ l} \quad 643 \text{ ml} \\ - 18 \text{ l} \quad 876 \text{ ml} \\ \hline \end{array}$$

$$\begin{array}{r} 10) \quad 39 \text{ l} \quad 764 \text{ ml} \\ - 28 \text{ l} \quad 876 \text{ ml} \\ \hline \end{array}$$

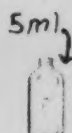
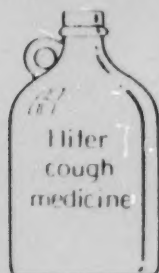
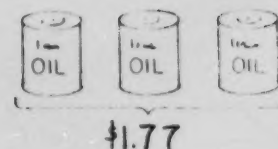
CAPACITY

Find the answers.

1. Anne's mother bought 1 liter of liquid cleaner. She used 150 mℓ to clean the stove and 30 mℓ to clean the kitchen table. How much liquid cleaner was left? _____ mℓ
2. There are 300 mℓ of soda pop in a bottle. How many bottles would it take to make 3 liters? _____ bottles
3. Mel bought 2 ℓ of milk at 43¢ per liter. How much money did he spend? \$ _____
4. Marlene bought 20 liters of gasoline at 20¢ per liter. How much did it cost? \$ _____
5. The gas tank in Tony's car holds 85 liters. How far can Tony travel on a full tank of gas if he gets 5 kilometers per liter of gasoline? _____ km
6. The gas tank in Amy's car holds 96 liters. She pulled into a gas station and told the attendant to "fill it up." It took 68.3 liters to fill the tank. How many liters were in the tank when Amy pulled into the gas station? _____ ℓ
7. Lila's cough medicine comes in 120 mℓ bottles. Before her cough went away, she used 3 bottles of medicine. How much medicine did she take all together? _____ mℓ
8. Mr. Fritz prepared 3 liters of punch for a dinner party. If 6 people eat dinner, how much punch would each person have? _____ ℓ
9. The label on a large can of juice reads, "Contents: 0.831 ℓ." How many liters of juice are there in 5 cans? _____ ℓ
10. Mary made punch for a party. She used 2 liters of orange juice, 1.8 liters of lemon soda, and 3.6 liters of ginger ale. How much punch did she make all together? _____ ℓ

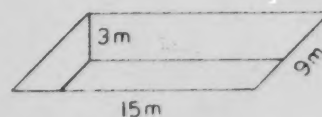
Problems About Volume

1. Andy bought 3 liters of motor oil for his car. He paid \$1.77 for the oil. How much did he pay for each liter? _____



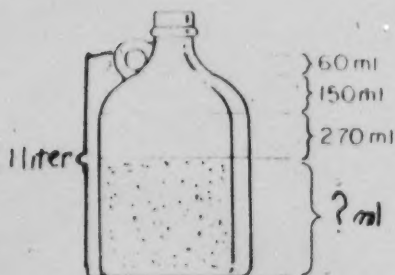
2. It takes 5 milliliters of cough medicine to make 1 bottle of Cough-Ez syrup. How many bottles of syrup can be made from 1 liter of cough medicine? _____ bottles

3. The excavation for the basement of a house had the dimensions given. What is the volume of earth that was removed? _____ cu m



4. In problem 3, it cost \$1.20 per cubic meter to remove the earth. What was the cost for the excavation? _____

5. Tom compared two cans of fruit juice in a grocery store. A 400 ml can sold for 58 cents. A 200 ml can sold for 30 cents. Which is more economical? _____ ml can



6. Tricia's mother bought 1 liter of liquid cleaner. She used 60 ml to clean a drawer, 150 ml for a door, and 270 ml for the stove. How much liquid cleaner did she have left? _____ ml

7. The gasoline tank on a sports car has a capacity of 60 liters. The car can travel 12 kilometers on a liter of gasoline. How far can it travel on a full tank of gasoline? _____ km

6.10.12 CAPACITY

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

The student will be able to...

5.10.12

identify the cubic centimeter;
add and subtract units of capacity.

NEW I.O.s

The student will be able to...

6.10.12.01

recognize a kiloliter and develop
an understanding of material that
approximate the volume of a kiloliter

6.10.12.02

identify that there are 1000 l in one
kiloliter

THE KILOLITER

A large unit is needed to measure liquids in large amounts such as the milk or gasoline that is hauled in big tank trucks. We use the kiloliter. The kiloliter (kl) is equivalent to 1000 liters.



Can you picture in your mind a cube with a capacity of 1000 liters? How big is it? It is 1 m long, 1 m wide, and 1 m high. To make a box this size would be a lot of work, but some of you may want to try it.

TRY THESE

1. 7 l = _____ ml
2. 5 l = _____ ml
3. 10 l = _____ ml

$$1 \text{ l} = 1000 \text{ ml}$$

4. 4 kl = _____ l
5. 3 kl = _____ l
6. 14 kl = _____ l

$$1 \text{ kl} = 1000 \text{ l}$$

Be careful.

7. 6 kl = _____ cl
8. 2 kl = _____ ml
9. 11,000 l = _____ kl

6.10.15 VOLUME

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

The student will be able to...

5.10.12

master all I.O.'s in the module.

identify a cubic centimeter(cm^3) as
a cube with dimensions of $1\text{cm} \times 1\text{cm} \times 1\text{cm}$.
(length x width x height)

5.10.13

master all I.O.'s in the module.

compute the area of rectangles in
units of square inches and square feet
using the equation $\text{area} = \text{length} \times$
width , $A = L \times W$

NEW I.O.s

The student will be able to...

6.10.15.01

find the volume of a rectangular prism
by counting the metric cubic units.

6.10.15.02

find the volume of rectangular prisms by
multiplying the length x width x height.*

*Note: length x width = base

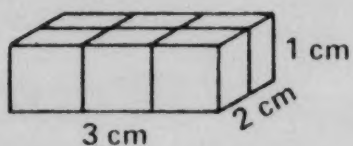
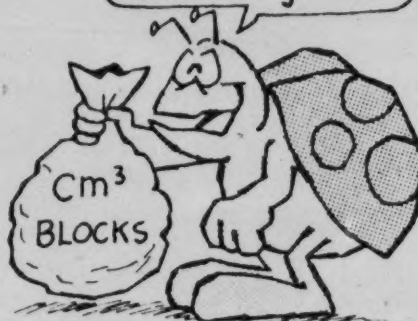
6.10.15.03 find the volume of a cylinder by
multiplying the area of the base by
the height. $V = b \times h$ or $V = (\pi r^2)h$

6.10.15.04 solve story problems related to the
above I.O.'s.

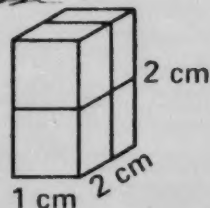
This is a cubic centimeter (cm^3).



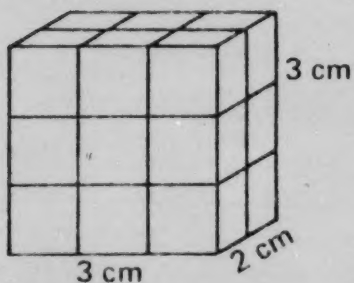
Use some cubic centimeter blocks to help you find the volume of these figures.



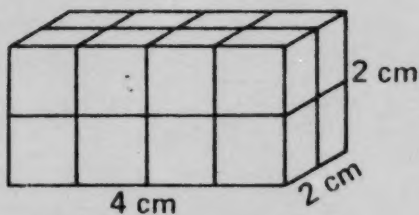
volume: 6 cm^3



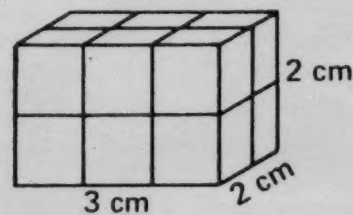
volume: _____ cm^3



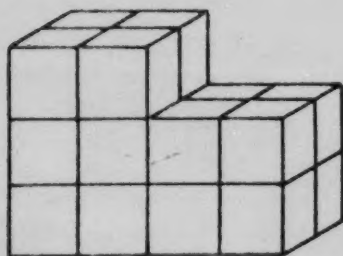
volume: _____ cm^3



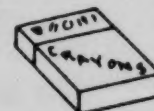
volume: _____ cm^3



volume: _____ cm^3



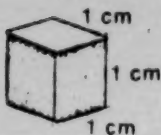
volume: _____ cm^3



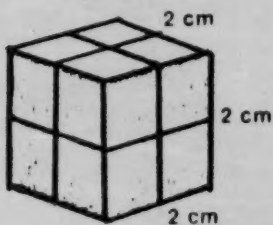
Collect some small boxes. How many centimeter cubes would fill each one?

Counting to Find Volume

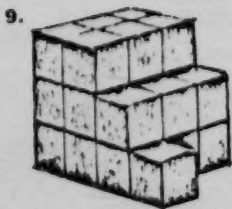
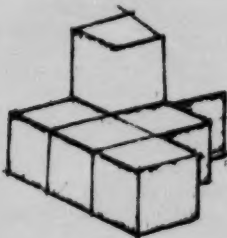
- A. This cube measures
1 centimeter on each side.
Its volume is
1 cubic centimeter (cm^3).



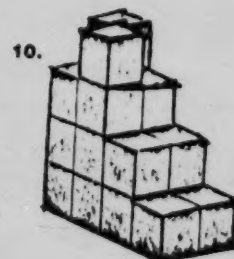
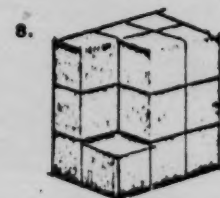
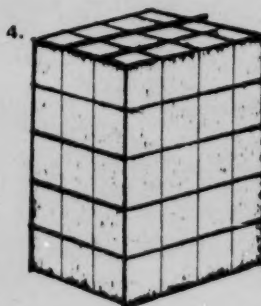
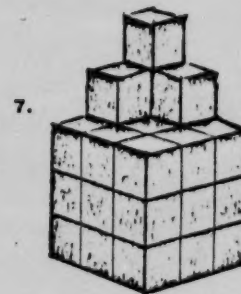
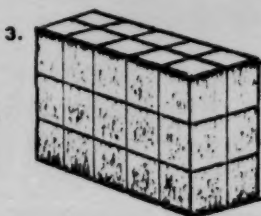
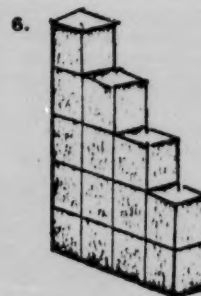
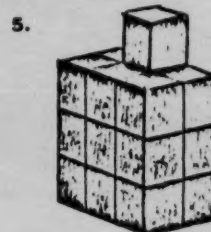
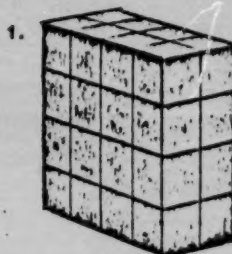
- B. The volume of this cube
is 8 cm^3 .



- C. The volume of this figure
is $\text{ } \text{cm}^3$.



These figures are made up of 1-centimeter cubes.
Count the cubes to find the volume of each figure.





How much
space inside?

Volume & Capacity



How much
will it hold?

Metric Units of Volume

Use blocks of any size to build the following.

Each block is shaped like a cube. Each block shows a cubic unit.

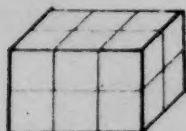


1. How many cubic units are needed to build this figure? ____

We say that the **volume** of the figure is 6 cubic units.

The *volume* of a figure is the number of cubic units it will hold.

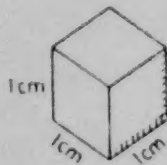
Now lay another layer of blocks on top as shown below.



2. How many cubic units are needed for this figure? ____

3. What is the volume of this figure? ____ cubic units

Two metric units of volume are shown below.



1 cubic centimeter

1 cm^3



1 cubic millimeter

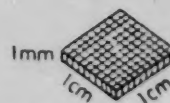
1 mm^3

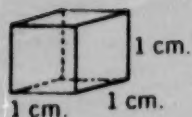
4. Which is larger, 1 cm^3 or 1 mm^3 ? ____

5. How many mm^3 are in this layer? ____

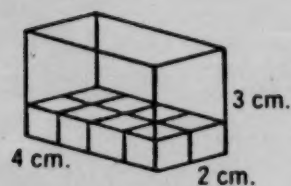
6. How many such layers are in 1 cm^3 ? ____

7. $1 \text{ cm}^3 = \text{-----} \text{ mm}^3$



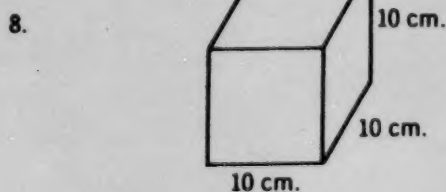
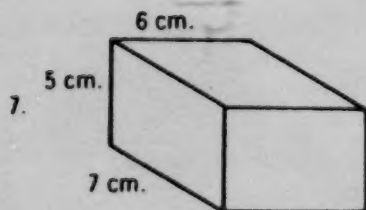
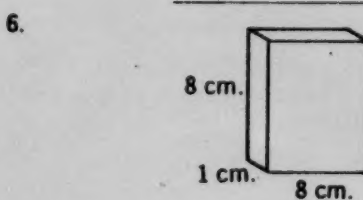
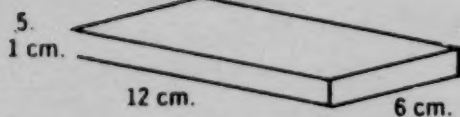
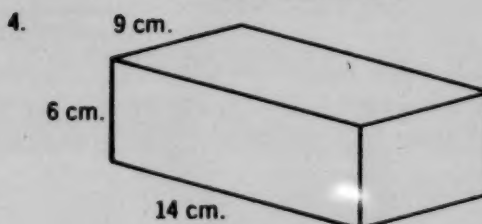
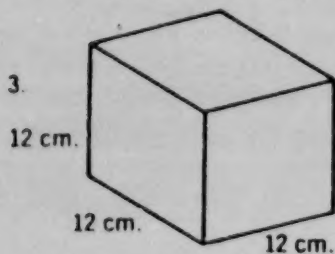
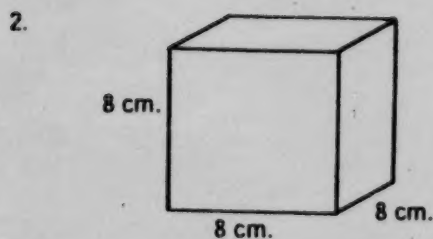
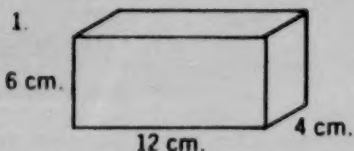


1 cubic container
Volume equals the length x width x height.



$$3 \times 4 \times 2 = 24 \text{ cu. cm.}$$

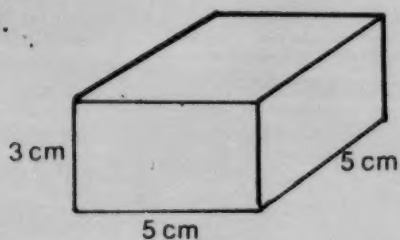
How many cubic centimeters will each box hold?



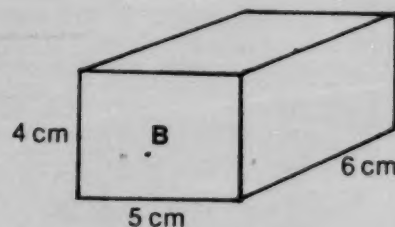
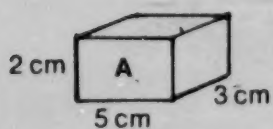
METRIC VOLUME

Find the volumes.

1.



Volume = _____ cm^3

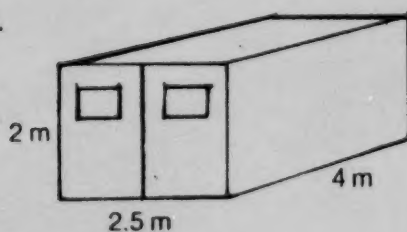


2. Volume of A = _____ cm^3

Volume of B = _____ cm^3

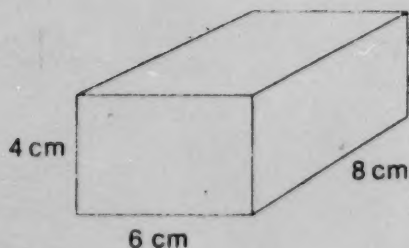
How much larger than A is B? _____ cm^3

3.



Volume = _____ m^3

4.



Volume = _____ cm^3

You can find the volume of a box by multiplying the length by the width by the height.



Who cares about volume. This is heavy!

LENGTH x WIDTH x HEIGHT = VOLUME

$$1 \text{ cm} \times 1 \text{ cm} \times 1 \text{ cm} = 1 \text{ cm}^3$$

$$2 \text{ cm} \times 3 \text{ cm} \times 1 \text{ cm} = \underline{\hspace{1cm}} \text{ cm}^3$$

$$5 \text{ cm} \times 4 \text{ cm} \times 2 \text{ cm} = \underline{\hspace{1cm}} \text{ cm}^3$$

$$2 \text{ cm} \times 2 \text{ cm} \times 3 \text{ cm} = \underline{\hspace{1cm}} \text{ cm}^3$$

$$7 \text{ cm} \times 5 \text{ cm} \times 2 \text{ cm} = \underline{\hspace{1cm}} \text{ cm}^3$$

$$\underline{\hspace{1cm}} \text{ cm} \times \underline{\hspace{1cm}} \text{ cm} \times \underline{\hspace{1cm}} \text{ cm} = \underline{\hspace{1cm}} \text{ cm}^3$$



Now measure the dimensions of some boxes and compute their volumes.



OBJECT LENGTH x WIDTH x HEIGHT = VOLUME

match

box $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

staple

gun $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

soap

box $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

chalk

box $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

$\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

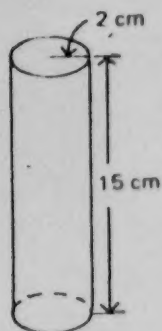
Volume and Surface Area of Cylinders and Cones

Find each volume in cubic units.

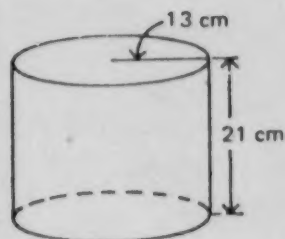
Volume of a cylinder

$$V = \pi r^2 h$$

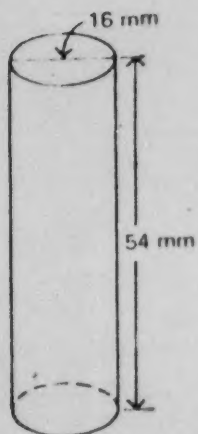
1.



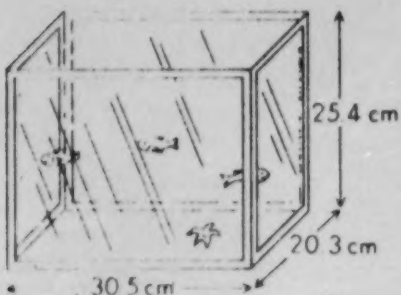
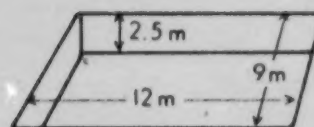
2.



3.



1. How much dirt must be removed to make a basement excavation as indicated? _____



2. What is the volume in cm^3 of the aquarium? _____

3. How many liters of water are needed to fill the aquarium? _____

4. The stainless steel ruler shown is 1 mm thick. How many mm^3 of stainless steel are contained in a ruler like this? _____



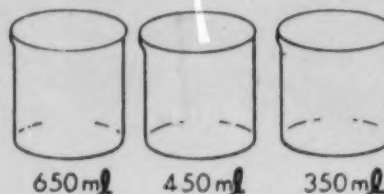
What is the amount in cm^3 _____



5. A pharmacist had 1 liter of medicine which he used to fill 30 smaller bottles with 25 ml each. How much medicine did he use in the 30 bottles? _____

How much medicine was left in the liter container? _____

6. A scientist is to mix the liquids shown in a single beaker. What will the volume (in ml) of the mixture be? _____



What is the volume in liters? _____

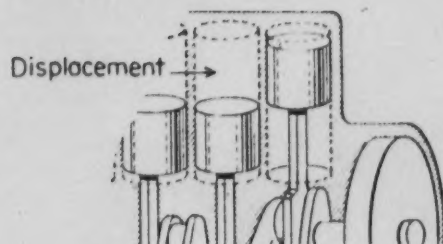
liter for 5 km

80 liters for ? km

7. Mrs. Langley's car averages 5 kilometers per liter (5 km/liter) of fuel. The capacity of its fuel tank is 82 liters. Allowing 2 liters as reserve, how far could she drive on a full tank of fuel? _____

CONTINUED NEXT PAGE

8. The total engine displacement for a car is 2 778 cm³. Each of the six cylinders has the same displacement. What is the displacement of each cylinder?

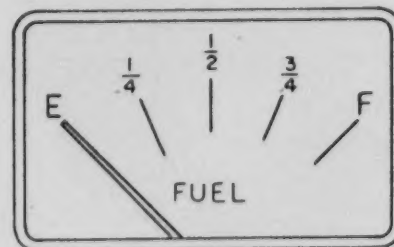


9. The oil capacity of a car is shown on the chart. What is the total oil capacity for this car?

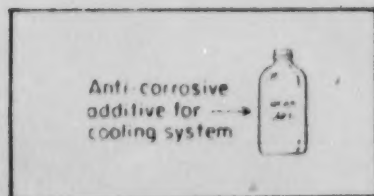
Oil Capacity	
crankcase	5.5 liters
oil filter	.5 liter
oil cooler	.5 liter
Fuel Capacity	
gasoline tank	2.5 dal
Radiator Capacity	
purified water	10.5 liters

10. A drum contains 20 dal of oil. Suppose it takes 6.5 liters for each oil change. How many complete oil changes can be made using the oil from this drum?

11. The gas tank of the car indicated on the chart above was filled to capacity. How many liters of fuel were in the tank?



12. The car in problem 11 was driven 395 km before running out of fuel. How many km/liter did the car get?



13. A cooling-system additive was poured into the radiator so the ratio of additive to water was 2.5 cm³ to 1 liter. How much additive was needed?

2.10.13 MASS (WEIGHT)

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

None

NEW I.O.s

The student will be able to...

2.10.13.01

define and compare non-standard
measurements in weight.

- a) same
- b) heavier, heaviest
- c) lighter, lightest

2.10.13.01

METHOD

Expose children to materials of various density
e.g., lead, stones styrofoam to show that mass isn't
dependent on size

1 Collect some things like:

thick book

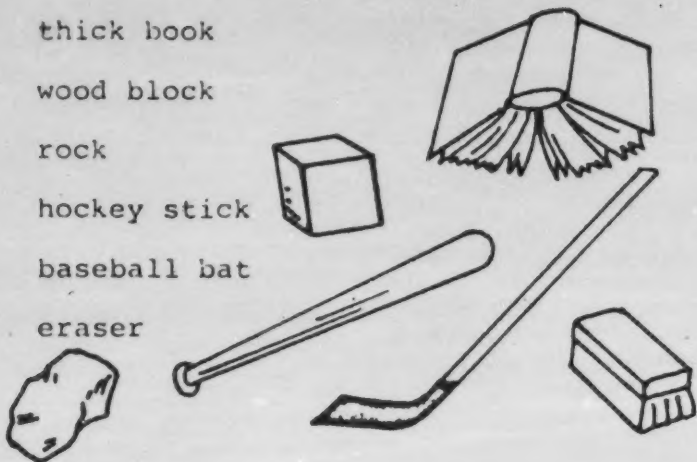
wood block

rock

hockey stick

baseball bat

eraser



M-28b-

2 / Guess the weight of these things.

Number them from lightest to heaviest.



Ask your partner
to do the same.

Look at your list
and your partner's.

Are they the same ?

42

Check anything different.

3 Find 2 other things -- maybe a paper weight and a flower pot.



Guess their weight. Fit them into your list.

Number your list again from 1 for the lightest thing.

4 / Put 10 of the same books in your partner's hand.

Put more than 10 --
say 16 or 17 in the
other hand.

Your partner's eyes
should be shut.

Take off one book
at a time until
your partner says
the weight is the
same in both hands.

Now you try it.

How good are you at estimating weights
that are the same ?



1.0. 2.10.5.6.7

3.10.13 MASS (WEIGHT)

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

The student will be able to...

- 2.10.13 master all I O's in the module.
non-standard measurements.
same, heavier, heaviest, lighter,
lightest

NEW I.O.s

The student will be able to...

- 3.10.13.01 identify a Kilogram (kg) as a standard
unit of mass
- 3.10.13.02 develop an understanding of objects
that approximate the weight of 1 kg.
- 3.10.13.03 estimate and measure the mass of objects
to the nearest kilogram
- 3.10.13.04 solve story problems related to the
above I.O.'s

MASS - A Personal Matter



Guess your metric mass: ____ kilograms.
 (Remember, kilograms are more than twice as large as pounds, so it will take less than half as many kilograms to equal your mass.) Check your guess by using a personal scale.

Now use the personal scale To find the mass of several large objects. You can hold the object while you stand on the scale; then subtract your mass from the reading on the dial.

Object	M A S S	
	Guess	Actual
1. Chair		
2. Stack of books		
3.		
4.		
5.		
6.		

The symbol "kg" is used for the word "kilogram."
A Little League baseball bat weighs about 1 kg.

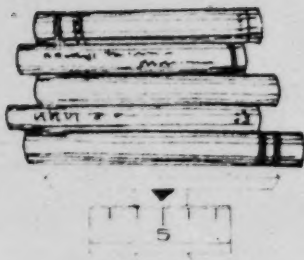


Altogether, four cartons of milk (the kind you
can get in your school cafeteria) weigh about 1 kg.

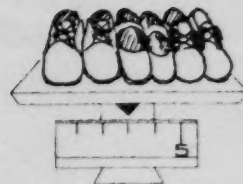


Name _____

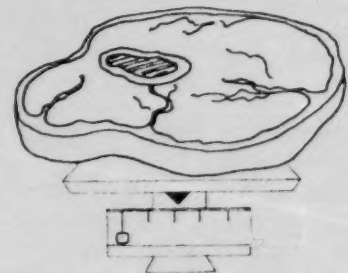
The kilogram is a unit of weight.
How much does each object weigh?



1. _____ kilograms



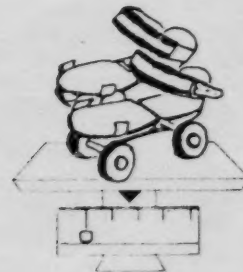
2. _____ kilograms



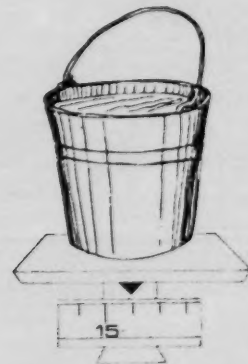
3. _____ kilograms



4. _____ kilograms



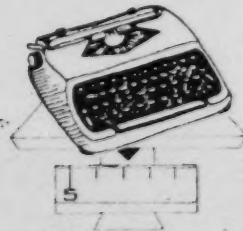
5. _____ kilograms



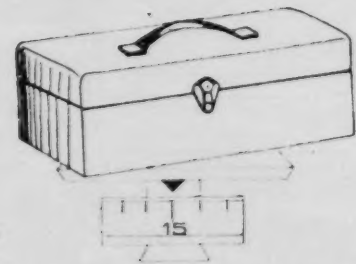
6. _____ kilograms



7. _____ kilograms



8. _____ kilograms



9. _____ kilograms

TERRY TIGER



1. It is feeding time at the zoo and Terry Tiger is very hungry. Mr. Henry, the zookeeper, gives her 12 kg of meat. He gives her the same amount of meat every day. How many kilograms of meat does Terry eat in three days?

_____ kg

2. There are 3 grizzly bears in the zoo. Each bear gets 10 kg of meat daily. How much meat does it take to feed all of the bears each day?

_____ kg

3. Which animal gets more meat each day, a tiger or a bear? _____

How much more?

_____ kg

4. Feeding all of the animals makes Mr. Henry hungry. For lunch he eats 10 hot dogs and 5 hamburgers. That much meat weighs about 1 kg. There are four other zookeepers who eat the same thing for lunch as Mr. Henry. About how many kilograms of meat are eaten by the 5 zookeepers?

_____ kg



4.10.13 (MASS (WEIGHT))

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

The student will be able to...

3.10.13

master all I.O.'s in the module:
estimate and measure the mass of objects
to the nearest kilogram (kg)

NEW I.O.s

The student will be able to...

4.10.13.01

identify a gram (g) as a standard unit
of mass;

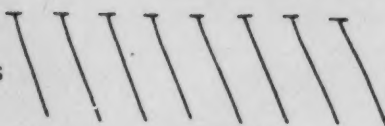
4.10.13.02

develop an understanding of objects
that approximate the mass of one gram (g);

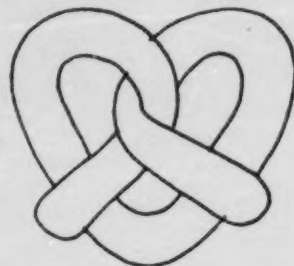
4.10.13.03

estimate and measure the mass of objects
to the nearest gram (g) - objects less
than one kg;

- 4.10.13.04 identify 1000 grams (g) is equal to
kilogram ;
- 4.10.13.05 compare grams (g) and kilograms and
determine which objects should be
measured in kg and which objects
should be measured in grams.
- 4.10.13.06 solve story problems related to the
above I.O.'s.

Eight straight pins  weigh about 1 gram.

One dime  weighs about 2 grams.

An extra-thick pretzel  weighs about 7 grams.

Hold a box or can in your hand and feel how heavy it is. Guess its weight in grams. Then look on the box or the label of the can to find its weight. Do this with many different containers until your guess is close to the actual weight.



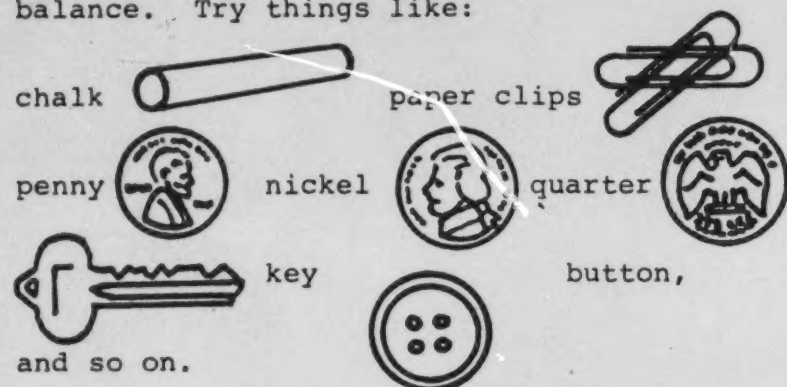
1.

Most countries of the world have agreed to use the same unit of weight.

It is called a **gram**.

2.

Get 5 small things and weigh them on a balance. Try things like:



Draw the things and write their weights.

3.

The short way of writing gram is g.
(Use a . period only at end of sentence.)

Read 5 g as five grams.

Read these weights to your partner:

3 g 21 g 1 g 96 g 149 g

53

4.

Look for some other small things.

Estimate their weights in grams. Make a list like this:

	Estimate	Weight
Eraser		
Pen		

Then use the balance and weigh them.

Fill in the list.

5.

Think of a way to make a 10 g weight.

6.

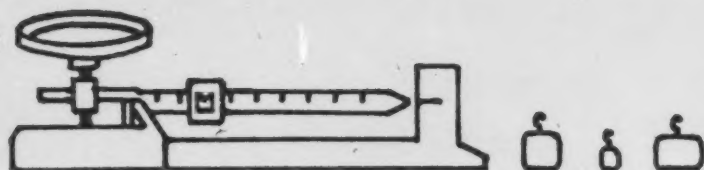
Use your balance. Get 10 steel thumb tacks. Balance the tacks and the clay.



Now you have a 10 g weight you can use.

1.

Get a scale with prepared weights.



Check your "10 g clay weight". How close is it to 10 g? Add or take away clay so it is exactly 10 g.

2.

To estimate the weight of a small thing, hold the 10 g weight in one hand and the thing you want to estimate in the other.

"Heft" them by moving your hands up and down to compare weights.



Try to tell from the feel of the weight which is heavier.

Which is heavier?

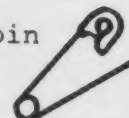
3.

Get 5 other small things.

Try a thimble



safety pin



dime



Do they weigh more or less than 10 g?

First estimate and then weigh each thing. Make a list like this:

	Estimate 10 g		Weight 10 g	
	More	Less	More	Less
thimble				
dime				

4.

Do these things weigh more or less than 10 g?

5 marbles



a yo-yo



a pencil



2 sheets of paper



6 baseball cards



eraser



Write your answers.

Another unit of weight is the gram.
A gram is much smaller than a kilogram.

How much does each object weigh?



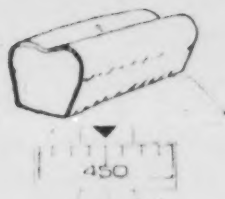
1. _____ grams



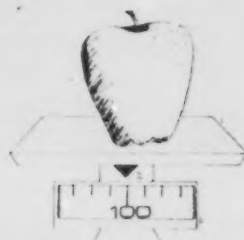
2. _____ grams



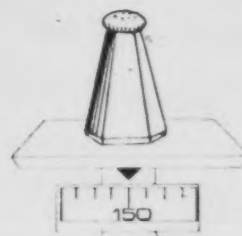
3. _____ grams



4. _____ grams



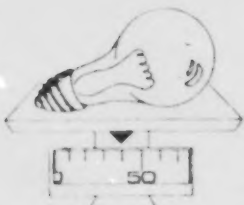
5. _____ grams



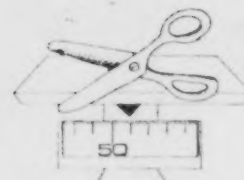
6. _____ grams



7. _____ grams



8. _____ grams



9. _____ grams

Imagine how much each object weighs in real life. Circle the best approximate weight for each object.



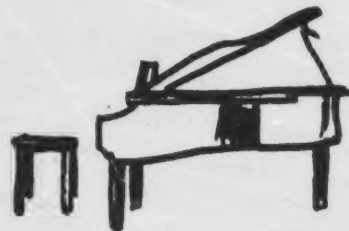
1. 200 kg 2 kg 200 g



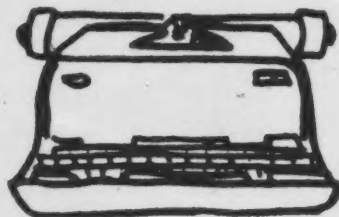
2. 1 g 350 g 10 kg



3. 10 g 100 g 1 kg



4. 300 g 300 kg 3 kg



5. 25 g 2 g 25 kg



6. 10 g 1 kg 100 kg



7. 55 kg 500 g 500 kg



8. 170 g 17 kg 17 g

EQUIVALENCIES

1. 2 kg = _____ g

6. 3000 g = _____ kg

2. _____ kg = 5000 g

7. 4000 _____ = 4 kg

3. 7 kg = 7000 _____

8. _____ g = 6 kg

4. 9 _____ = 9000 g

9. 8000 g = 8 _____

5. 12 kg = _____ g

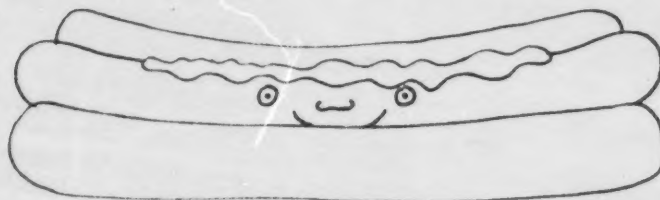
10. 23,000 g = _____ kg

IF..., HOW MANY...?

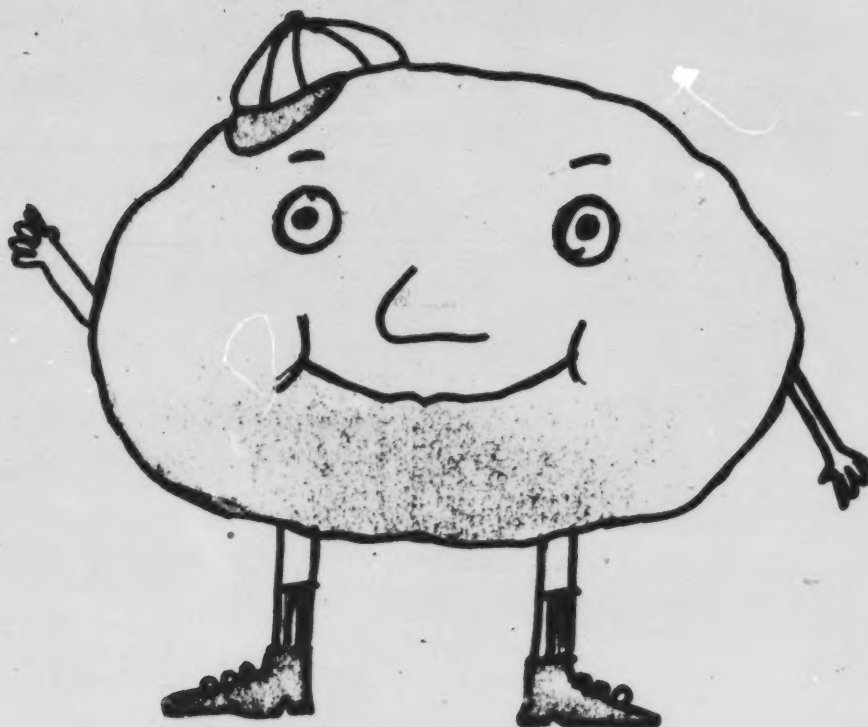
11. If one pretzel weighs about 7 grams, how many pretzels will weigh 1 kilogram? (Round off to the nearest 10.) _____

12. If one dime weighs about 2 grams, what is the value of 100 grams of dimes? _____

13. If 20 hot dogs weigh about 1 kilogram, how many grams does 1 hot dog weigh? _____ g



HARRY HAMBURGER



Harry was a super-duper hamburger. He weighed 1000 grams. Mr. O'Leary made Harry at the meat market and put him in the meat case. Mr. O'Leary liked to see people laugh when they saw Harry. Harry was so big.

Harry had fun too. He liked to watch the people at the meat market.

1. One day Ted came into the market and asked for 100 hot dogs. Altogether the hot dogs weighed 5 kg. The price of hot dogs is \$1 40 for each kilogram. How much did Ted have to pay? _____

CONTINUED, NEXT PAGE

2. Mrs. Wilson bought 4 kg of soup bones that cost \$.40 per kilogram. Then she got 2 kg of chicken that cost \$.80 per kg. How much did she pay? _____

3. Tackle, the star of the football team, was on his way home from a game. He felt really hungry! He bought some steaks that weighed 10 kg in all. What was the cost of the steaks if the price per kilogram is \$3.80? _____



4. Some children wanted to buy Harry. Mr. O'Leary said that Harry would cost \$1.98. The children put all of their money together. They had 4 quarters, 7 dimes, and 9 nickels. Did they have enough to buy Harry? _____ Was there any money left over? _____ If so, how much? _____

5.10.13 MASS (WEIGHT)

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

The student will be able to...

4.10.13

master all I.O.'s in the module:

identify 1000 g = 1 kg.

compare grams and kilograms and

determine which objects should

be measured in kilograms or in grams.

NEW I.O.s

The student will be able to...

5.10.13.01

identify a metric ton as 1000 kg.

5.10.13.02

identify 1000 milligrams (mg) as a gram.

5.10.13.03

add and subtract units of mass with no regrouping (using kilograms and grams)

e.g.,

2 kg	480g
-1 kg	70g
1 kg	410g

5.10.13.04

add units of mass in grams (over 1000g)
regrouping into kg and g.

e.g.,
$$\begin{array}{r} 780\text{g} \\ +340\text{g} \\ \hline \end{array}$$

5.10.13.05

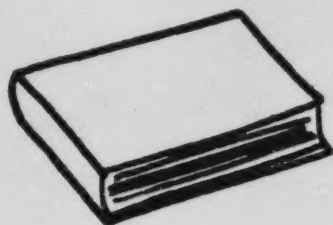
add and subtract units of mass in kg and
g with regrouping into kg and g.

e.g.,
$$\begin{array}{r} 2\text{ kg } 70\text{g} \\ -1\text{ kg } 480\text{g} \\ \hline \end{array}$$

5.10.13.06

solve story problems related to the
above I.O.'s.

Imagine how much each object weighs in real life. Circle the best approximate weight for each object.



1. 1 t 1 g 1 kg



2. 175 g 2 kg 500 g



3. 10 g 10 t 29 kg



4. 500 g 4 kg 4 t



5. 125 g 1 t 10 kg



6. 130 g 8 kg 100 kg



7. 5 t 4000 g 400 kg



8. 2 t 200 g 25 kg

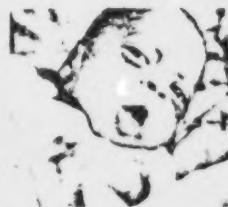
GRAMS, KILOGRAMS, AND METRIC TONS

The basic unit of the metric system of weights is the gram. The abbreviation for gram is **g**. The gram is a very small unit of weight. A gram is the weight of one cubic centimeter of water. An ordinary paper clip weighs about one gram. A thumbtack also weighs about 1 gram. A nickel weighs about 5 grams. A can of condensed alphabet soup weighs 305 grams.



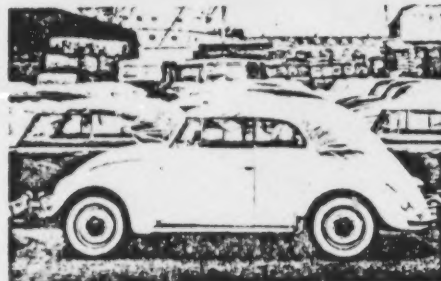
A kilogram (kg) is 1000 grams. A kilogram is the weight of a liter of water. Your weight and the weights of large quantities of food such as meat and vegetables are measured in kilograms.

A thousand paper clips would weigh about 1 kilogram. Two standard loaves of bread weigh about 1 kilogram. An average newborn baby weighs between 3 and 4 kilograms. A woman may weigh about 60 kilograms.



The third unit of weight in the metric system is the metric ton (t). A metric ton is equal to 1000 kilograms.

The metric ton is used for the weights of heavy objects like cars and trucks. A small foreign car weighs a little more than 1 metric ton.



The gram, kilogram, and metric ton are the most commonly used units of weight. All the metric units of weight have the same prefixes as the other metric units. Here is a table of metric weights.

10 milligrams (mg) = 1 centigram (cg)
 10 centigrams (cg) = 1 decigram (dg)
 10 decigrams (dg) = 1 gram (g)
 10 grams (g) = 1 dekagram (dag)
 10 dekagrams (dag) = 1 hectogram (hg)
 10 hectograms (hg) = 1 kilogram (kg)
 1000 kilograms (kg) = 1 metric ton (t)

You should remember:

1000 grams (g) = 1 kilogram (kg)
 1000 kilograms = 1 metric ton (t)

GRAMS, KILOGRAMS, AND METRIC TONS

On the chart below, check the unit you would use for weighing each item. For example, what unit would you use if you were going to weigh your pencil? Would you use grams, kilograms, or metric tons? A pencil is small and does not weigh very much. Therefore, you would express its weight in grams.

	Grams	Kilograms	Tons
A truck			
A boy			
A can of frozen orange juice			
An elephant			
A goldfish			
A jar of peanut butter			
A bag of potato chips			
An ocean liner			
A dog			
A bag of groceries			
A jet airplane			

THE MILLIGRAM

The centigram is a unit of measure which is not used very often. The milligram is more commonly used to measure a mass (or weight) of less than 1 gram.

You learned that "milli-" means "_____".
The milligram (mg) is 1 of 1000 parts of the gram (⁽¹⁾ $\frac{1}{1000}$ g).

$$1 \text{ g} = 1000 \text{ mg}$$

Cut out the region in the lower right corner of this page. It weighs about 1 mg. Hold it in your hand. You can't really feel it, can you?

Look at the label on a bottle of vitamins. The amount of different vitamins in each tablet is shown on the label in milligrams. The amount of vitamins in cereal is listed on the box in the same way.



One dry-roasted sunflower seed  has a weight of about 60 mg.

PRACTICE

$$1 \text{ g} = 1000 \text{ mg}$$

2. 5 g = _____ mg

3. 7 g = _____ mg

4. 2000 mg = _____ g

5. 9000 mg = _____ g

6. 8 _____ = 8000 mg

7. 6000 mg = _____ g

8. 4000 _____ = 4 g

Find the answers. Regroup if you can.

$$\begin{array}{r} 1. \quad 72 \text{ kg } 8 \text{ g} \\ + 14 \text{ kg } 6 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 2. \quad 35 \text{ kg } 600 \text{ g} \\ \quad 9 \text{ kg } 100 \text{ g} \\ + 61 \text{ kg } 300 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 3. \quad 248 \text{ kg } 12 \text{ g} \\ + 112 \text{ kg } 18 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 4. \quad 306 \text{ kg } 16 \text{ g} \\ \quad 87 \text{ kg } 90 \text{ g} \\ + 129 \text{ kg } 2 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 5. \quad 570 \text{ kg } 70 \text{ g} \\ \quad 244 \text{ kg } 5 \text{ g} \\ + 108 \text{ kg } 40 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 6. \quad 429 \text{ kg} \\ \quad 363 \text{ kg} \\ + 51 \text{ kg} \\ \hline \end{array}$$

$$\begin{array}{r} 7. \quad 79 \text{ kg } 43 \text{ g} \\ - 32 \text{ kg } 12 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 8. \quad 50 \text{ kg } 850 \text{ g} \\ - 41 \text{ kg } 250 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 9. \quad 110 \text{ kg } 2500 \text{ g} \\ - 67 \text{ kg } 500 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 10. \quad 206 \text{ kg } 750 \text{ g} \\ - 149 \text{ kg } 25 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 11. \quad 151 \text{ kg } 200 \text{ g} \\ - 72 \text{ kg} \\ \hline \end{array}$$

$$\begin{array}{r} 12. \quad 953 \text{ kg } 298 \text{ g} \\ - 605 \text{ kg } 75 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 13. \quad 36 \text{ kg } 690 \text{ g} \\ \quad 42 \text{ kg } 700 \text{ g} \\ + 9 \text{ kg } 610 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 14. \quad 101 \text{ kg} \\ \quad 57 \text{ kg } 200 \text{ g} \\ + 30 \text{ kg } 925 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 15. \quad 8 \text{ kg } 1100 \text{ g} \\ \quad 316 \text{ kg } 900 \text{ g} \\ + 65 \text{ kg } 600 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 16. \quad 422 \text{ kg } 75 \text{ g} \\ \quad 116 \text{ kg } 20 \text{ g} \\ + 50 \text{ kg } 3 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 17. \quad 260 \text{ kg } 407 \text{ g} \\ + 723 \text{ kg } 720 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 18. \quad 838 \text{ kg } 953 \text{ g} \\ + 119 \text{ kg} \\ \hline \end{array}$$

$$\begin{array}{r} 19. \quad 68 \text{ kg } 1200 \text{ g} \\ - 25 \text{ kg } 200 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 20. \quad 83 \text{ kg } 1350 \text{ g} \\ - 47 \text{ kg } 125 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 21. \quad 130 \text{ kg } 2000 \text{ g} \\ - 62 \text{ kg } 900 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 22. \quad 222 \text{ kg } 73 \text{ g} \\ - 59 \text{ kg } 69 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 24. \quad 371 \text{ kg } 400 \text{ g} \\ - 108 \text{ kg } 299 \text{ g} \\ \hline \end{array}$$

$$\begin{array}{r} 25. \quad 600 \text{ kg } 1435 \text{ g} \\ - 496 \text{ kg } 196 \text{ g} \\ \hline \end{array}$$

PRACTICE WITH WEIGHT

Do the following:

1. John weighs 74 kg and his sister, Susan, weighs 56 kg. Find the difference in their weights. _____
2. The Smith's new baby weighs 3 kg. If she doubles her weight in six months, how much will she weigh? _____
3. Mrs. Brown bought 500 g of meat, 2 kg of potatoes, 300 g of tomatoes. What was the total weight of her purchase? (Use one unit in your answer.) _____
4. Jimmy's father has a truck that can carry 10 metric tons. How many kilograms is that? _____
5. Suppose a box of erasers weighs .024 kg and a box of chalk weighs 27 g. Which is heavier? _____ How much heavier is it in grams? _____ In kilograms? _____
6. Mother made a casserole using $\frac{1}{2}$ kg of hamburger and $\frac{1}{4}$ kg of sausage. If she served the casserole in four equal portions, how much did each person have in kilograms? (a) _____ grams? (b) _____
7. If meat costs \$2.40 a kg, how much could you buy for \$12.00? _____
8. If a farmer sold 4.5 tons of potatoes at 6 cents a kilogram, how much money did he receive? _____
9. If one kilogram of meat is enough for 10 people, how much meat is needed for 450? _____
10. A truck weighs 10 198 kg when loaded. If the empty weight of the truck is 5 648 kg, what is the weight of the load? _____
11. If a liquid weighs 0.8 as much as the same amount of water, what is the weight of 20 liters of it? _____ (Hint: 1 liter weighs _____ kilogram?)
12. If a container of coffee costs \$3.00 per kilogram, what would 500 grams cost? _____ (Hint: 500 grams = _____ kilograms?)

6.10.13 MASS (WEIGHT)

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

The student will be able to ...

5.10.13

master all I.O.'s in the module

identify 1000 kg = 1 t
 1000 mg = 1 g

add and subtract units of mass in kg
and g with regrouping into kg and g.

NEW I.O.'s

The student will be able to ...

6.10.13.01

solve story problems related to
mass.

GRAMS, KILOGRAMS, AND METRIC TONS

Solve the problems.

1. What is the total weight of 100 g of candy, 50 g of bubble gum, and 75 g of peanuts? _____ g
2. One orange weighs 175 g. How much do 3 oranges weigh? _____ g
3. The bread weighs 260 g more than the cheese. The cheese weighs 300 g. How much does the bread weigh? _____ g
4. Butter costs \$1.00 for 500 g. How much butter can you buy for \$2.00? _____ g
5. Sally mixes 260 g of flour, 200 g of sugar, and 245 grams of butter. How much does the whole mixture weigh? _____ g
6. One apple weighs 110 g and one orange weighs 160 g. How much more than two apples do two oranges weigh? _____ g
7. Suzette's dinner consists of 150 g of cooked ham, 125 g of potatoes, 100 g of peas, and 160 g of fruit salad. How much does Suzette's dinner weigh? _____ g
8. Ronnie eats 150 g of peanuts, while Dave eats 111 g. How many more grams of peanuts does Ronnie eat than Dave? _____ g
9. A box of crackers weighs 342 grams. The crackers are packed in 3 cellophane wrappers. If each of the 3 packages has the same weight, how much does each package weigh? _____ g
10. Tammy's popsicle weighs 74 g. How much does it weigh after Tammy has eaten half of it? _____ g

LAST NAME

FIRST NAME

71

CLASS

DATE

GRAMS, KILOGRAMS, AND METRIC TONS

Solve the problems.

1. Jeff weighs 45 kg and his baby brother weighs 5 kg.
How much more does Jeff weigh than his brother? _____ kg
2. Anne weighs 3 kg less than her older sister. If her sister
weighs 41 kg, how much does Anne weigh? _____ kg
3. Jim weighs 35 kg. His father weighs 69 kg. His mother
weighs 53 kg. How much do they all weigh together? _____ kg
4. Suppose a station wagon weighed 2 t. An auto carrier
hauls 5 station wagons. How much weight does it haul? _____ t
5. Julie and her mother weigh 82 kg together. If her mother
weighs 53 kg, how much does Julie weigh? _____ kg
6. Bob can lift twice as much weight as Carl. If Carl can lift
27 kg, how much can Bob lift? _____ kg
7. Lisa's bicycle weighs 3 kg less than her wagon. If her
bicycle weighs 8 kg, how much does her wagon weigh? _____ kg
8. Alice gained 9 kg during the last 3 years. If she weighed
28 kg three years ago, how much does she weigh now? _____ kg
9. An ocean liner weighs 31,000 t. It takes on 78 t of cargo,
65 t of passengers and luggage, and 43 t of food and
water. How much does it weigh when it sets sail? _____ t
10. Cindy, Jimmy, and Julie weigh 108 kg all together. If
Cindy weighs 23 kg and Jimmy weighs 38 kg, how
much does Julie weigh? _____ kg

1.10.14 CELSIUS TEMPERATURE

INSTRUCTIONAL OBJECTIVES

NEW I.O.s

The student will be able to...

1.10.14.01

define and contrast non-
standard terms - hot, cold,
hotter, hottest, colder, coldest.

1.10.14.02

identify a thermometer as an
instrument to measure temperature.

1.10.14.03

read a ribbon thermometer in non-
numerical terms.

e.g., higher is warmer

lower is colder

WHAT IS A THERMOMETER ?

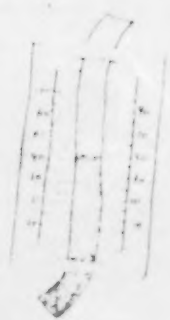
A. PURPOSE: TO INTRODUCE THE CONCEPT OF THE USE OF A THERMOMETER.

B. MATERIALS : A THERMOMETER, A PAPER MODEL OF A THERMOMETER.

C. INTRODUCTION : IS IT HOT OR COLD IN THE ROOM TODAY ? OUTSIDE ?

HOW DO YOU KNOW ? YES, YOU FEEL IT. HOW CAN WE TELL IF IT IS HOT OR COLD OUTSIDE WITHOUT GOING OUT ? (DISCUSS) WE CAN CHECK THE TEMPERATURE ON THE NEWS OR IN THE PAPER. HOW DOES THE WEATHERMAN KNOW ? HE USES A THERMOMETER. I HAVE A PAPER THERMOMETER HERE. WHEN THE RED STRIP IS HIGH, WHAT IS THE TEMPERATURE ? YES, IT IS HOT. WHEN THE RED STRIP IS LOW ON THE SCALE, WHAT IS THE TEMPERATURE ? COLD. I WILL MOVE THE RED MARK AND YOU TELL ME IF IT IS HOT OR COLD (DO SO) NOW LET'S LOOK AT A REAL THERMOMETER. CAN YOU SEE THE RED (OR GRAY) LINE ? WE WILL READ IT EACH DAY AND WRITE THE TEMPERATURE ON THE BOARD.

D. PROCEDURE: IN MAKING THE PAPER THERMOMETER, STRIPS OF TAPE OR CONSTRUCTION PAPER CAN BE USED. GLUE TOGETHER A PIECE OF RED AND PIECE OF WHITE PAPER TO MAKE THE "MERCURY COLUMN."

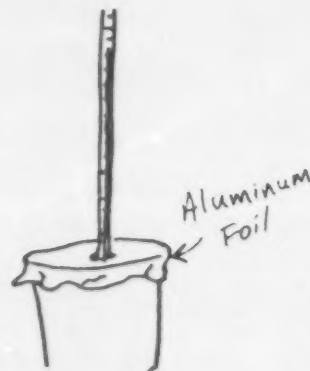


HOW HOT IS HOT ?

A. PURPOSE: TO ACQUAINT STUDENTS WITH THE MERCURY LEVEL IN A THERMOMETER AT DIFFERENT TEMPERATURES.

B. MATERIALS : WARM WATER, ICE CUBES, THERMOMETER, FOIL.

C. INTRODUCTION : I HAVE 2 PANS OF WATER (OR CUPS) HERE.
WHO CAN TELL ME WHICH IS WARMER ? HOW ?
IF YOU USE A THERMOMETER WITHOUT TOUCHING
THE CUP WITH YOUR HAND, CAN YOU TELL ?
AS YOU HOLD THE THERMOMETER IN THE WATER,
WATCH THE MERCURY LINE. I HAVE PLACED ALUMINUM
FOIL COVERS ON THE CUPS SO YOU CANNOT SEE
INTO THEM. CAREFULLY INSERT THE THERMOMETER
INTO THE CUP AND WATCH IT. (BY USING A
TEMPERATURE VARIANCE OF 10 , THE STUDENTS
WILL NOT BE ABLE TO FEEL THE CUPS AND TELL
WHICH ONE IS WARMER) _



• TEMPERATURE CHART

for the week of _____

DAY 

TIME 

TEMP. 

MON.

	°C
--	----

• TUES.

	°C
--	----

WED.

	°C
--	----

THURS.

	°C
--	----

• FRI.

	°C
--	----

2.10.14 CELSIUS TEMPERATURE

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

The student will be able to...

1.10.14

master all I.O.'s in the module.

read a ribbon thermometer in
non-numerical terms.

e.g., higher is warmer

lower is colder

NEW I.O.s

The student will be able to...

2.10.14.01

define a degree as the standard
unit for measuring temperature.

2.10.14.02

read and demonstrate temperature
using a ribbon thermometer at intervals
of 10°C, above zero.

2.10.14.03

read and demonstrate temperature
using a ribbon thermometer at intervals
of 5°C, above zero.

2.10.14.04

identify cold and hot temperatures.

e.g., 40°C a very hot summer day

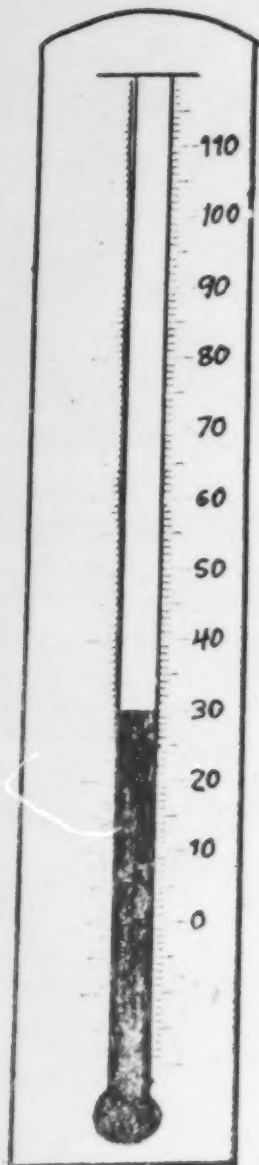
20°C a spring day

2.10.14.05

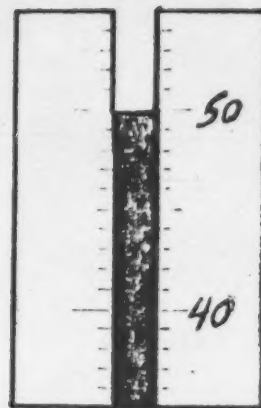
solve story problems related

to the above I.O.s.

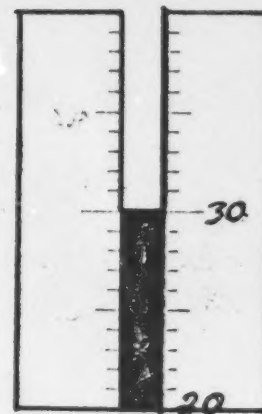
What is the temperature?



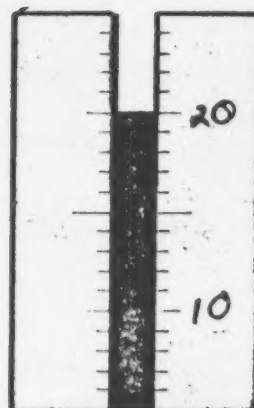
30 degrees



_____ degrees



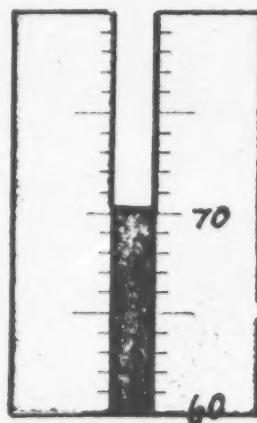
_____ degrees



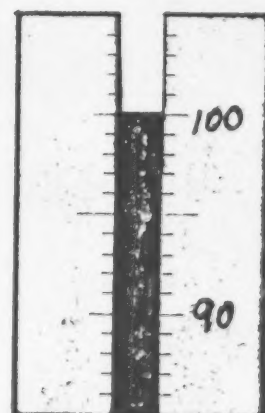
_____ degrees



_____ degrees

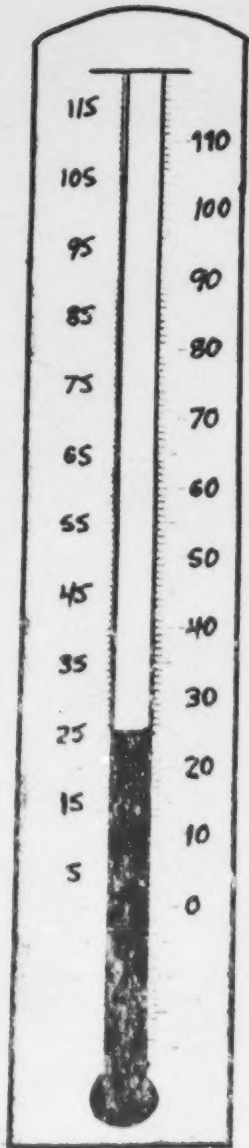


79 _____ degrees

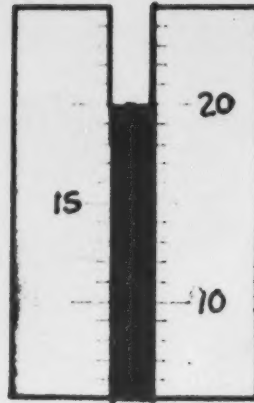


_____ degrees

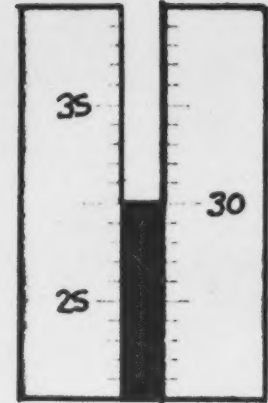
What is the temperature?



25 degrees



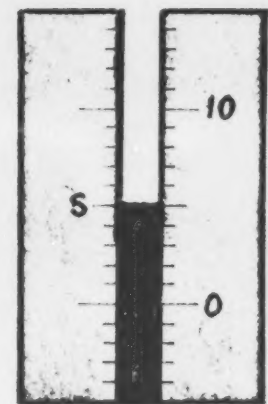
_____ degrees



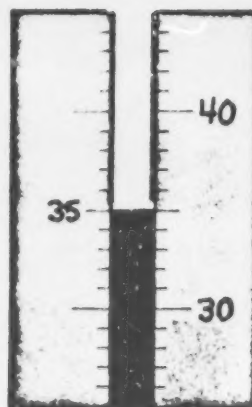
_____ degrees



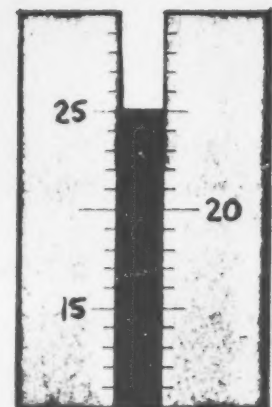
_____ degrees



_____ degrees



_____ degrees



_____ degrees

• TEMPERATURE CHART

for the week of _____

DAY 

TIME  TEMP. 

MON.

	°C
--	----

• TUES.

	°C
--	----

WED.

	°C
--	----

THURS.

	°C
--	----

• FRI.

	°C
--	----

81

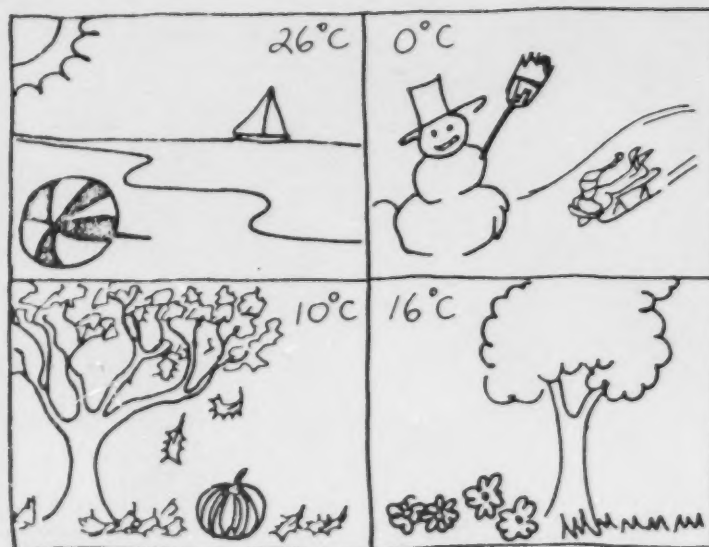
WHAT WILL YOU WEAR ?

A. PURPOSE : TO CORRELATE WEATHER CONDITIONS WITH TEMPERATURE READINGS AND MODE OF DRESS REQUIRED.

B. MATERIALS : A SERIES OF PICTURES WHICH DEPICT THE FOUR SEASONS.

C. INTRODUCTION : AS THE SEASONS CHANGE, WE MUST ALSO CHANGE OUR MANNER OF DRESSING. (SHOW A PICTURE) WHAT WOULD YOU WEAR IN THIS WEATHER ? (DISCUSS) LET'S WRITE A TEMPERATURE AVERAGE ON EACH OF THE PICTURES.

D. PROCEDURE : PICTURES FROM MAGAZINES, ETC., WILL SERVE WELL FOR FOR THIS EXERCISE. OR, YOU CAN HAVE STUDENTS SKETCH SCENES AND LABEL THEM: THEN PUT SOME TEMPERATURE READING ON THEM.



3.10.04 CELSIUS TEMPERATURE

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

The student will be able to...

2.10.14

master all I.O.'s in the module.

read and demonstrate temperature
at intervals of 10°C and 5°C above
zero.

identify cold and hot temperatures.

NEW I.O.s

The student will be able to...

3.10.14.01

read and demonstrate temperature
using a ribbon thermometer at
intervals of 2°C, above zero.

3.10.14.02

read and demonstrate temperature
using a ribbon thermometer at
intervals of 1°C, above zero.

- 3.10.14.03 identify the boiling temperature
of water as 100°C.
- 3.10.14.04 identify the freezing temperature
of water as 0°C.
- 3.10.14.05 identify body temperature as
37°C.
- 3.10.14.06 solve problems related to the above
I.O.'s.

● TEMPERATURE CHART

for the week of _____

DAY 

TIME  TEMP. 

MON.

	°C
--	----

● TUES.

	°C
--	----

WED.

	°C
--	----

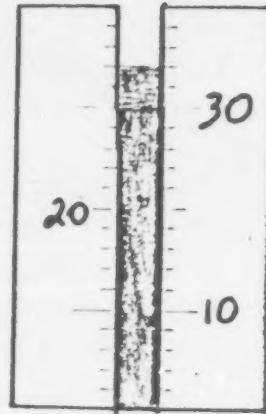
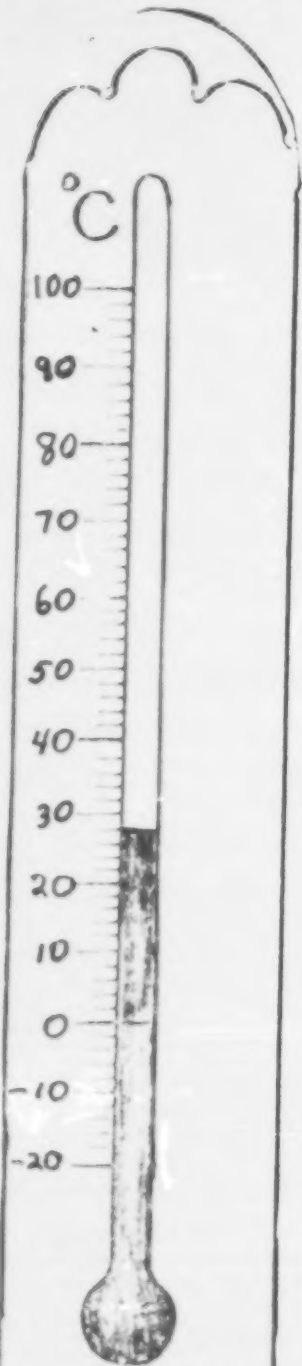
THURS.

	°C
--	----

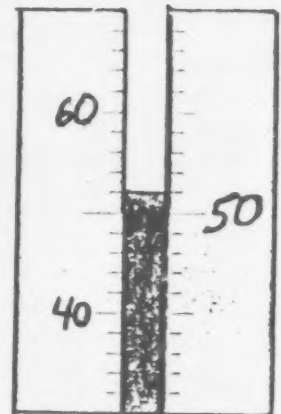
● FRI.

	°C
--	----

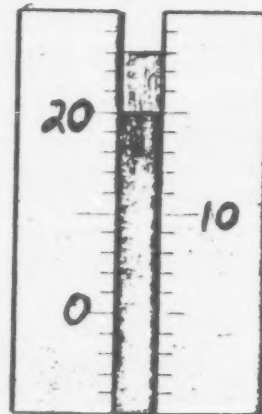
What is the temperature?



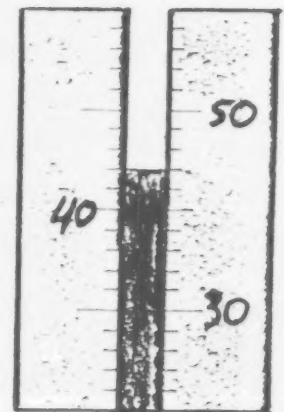
_____ degrees



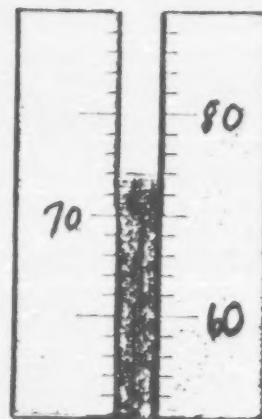
_____ degrees



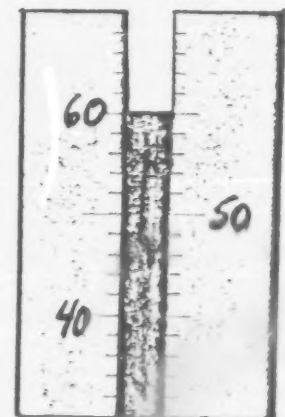
_____ degrees



_____ degrees

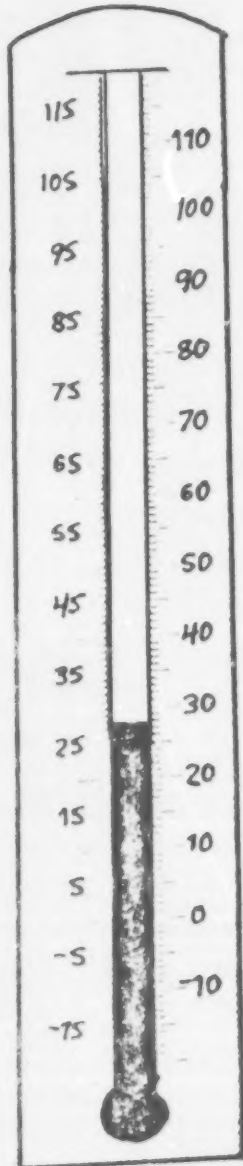


_____ degrees

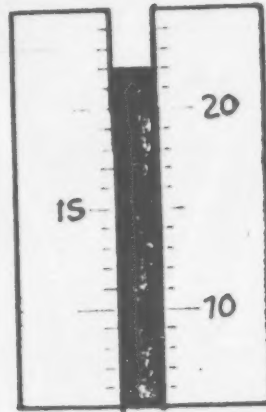


_____ degrees

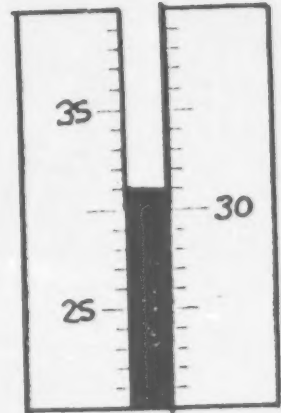
What is the temperature?



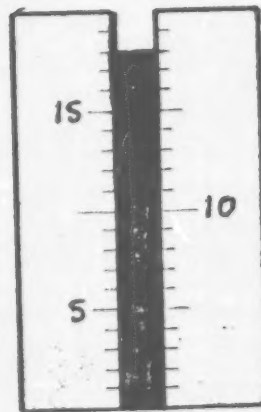
28 degrees



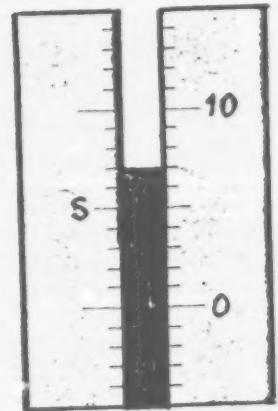
_____ degrees



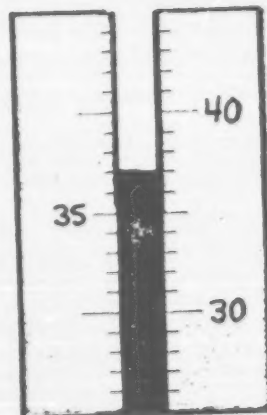
_____ degrees



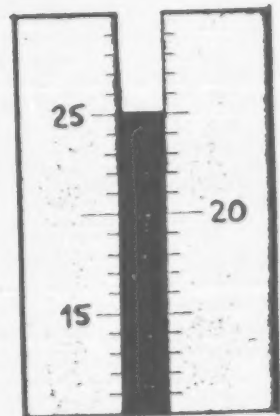
_____ degrees



_____ degrees

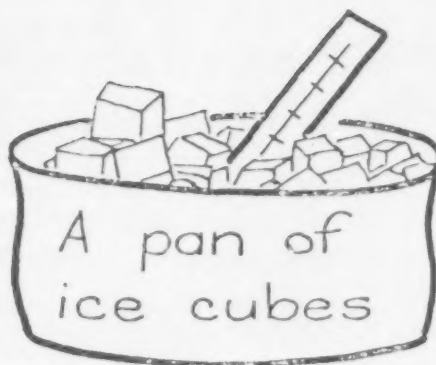
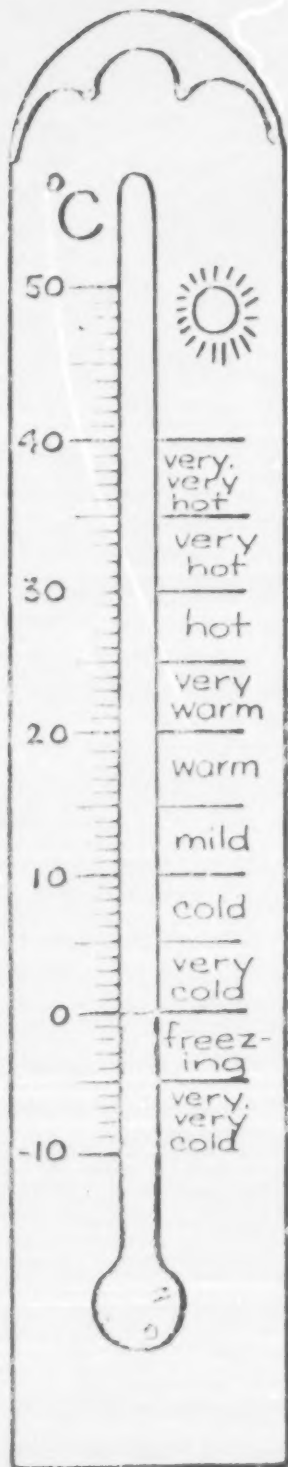


87 _____ degrees



_____ degrees

EXPLORING TEMPERATURE



A pan of ice cubes

Water freezes at 0°C



A pan of boiling water

Water boils at 100°C

Use a Celsius thermometer to measure 3 temperatures.
List them.

Place	Time	Temperature
-------	------	-------------

THE CELSIUS SCALE

In the metric system the scale used for measuring temperature is called the **Celsius scale**. Its name comes from the Swedish astronomer, Anders Celsius. He developed the Celsius scale in 1742.

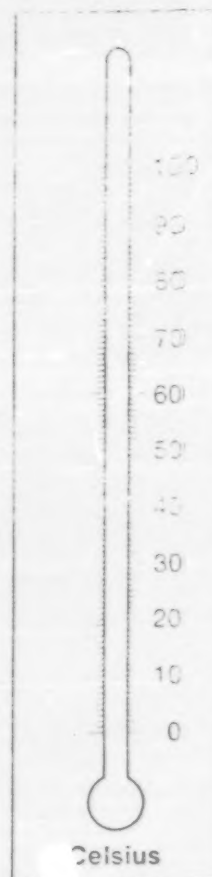


On the **Celsius thermometer**, 0° ($^{\circ}$ means *degrees*) is the freezing point of water and 100° is the boiling point of water. There are 100° between freezing and boiling. Look at the thermometer at the left.

Sometimes the Celsius scale is called the **centigrade scale**. You have learned that the prefix *centi-* means hundredths. What do you think *centigrade* means? Hint: Look at the thermometer at the right.

There are other scales used to measure temperature. So when you record a temperature taken on a Celsius thermometer, write C after it.

Water freezes at 0°C .
Water boils at 100°C .



Read 0°C as "zero degrees Celsius." How would you read 100°C ? _____

How would you read 48°C ? _____

73°C ? _____

Using the Celsius Thermometer

Look at the thermometer at the right. The solid line in the center represents the fluid in a real thermometer. The level is between 30°C and 40°C. What temperature is

shown? _____ This is your normal body temperature on the Celsius scale.

What approximate temperatures are shown for these?

Milk _____

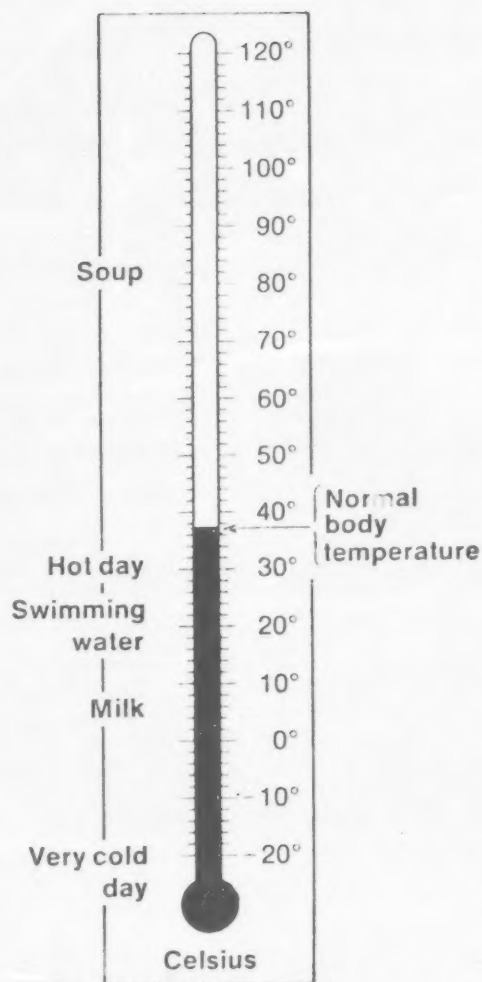
Soup _____

Hot day _____

Water for swimming _____

What temperature do you like the best? _____

Draw a picture of what you would like to be doing when it is your favorite temperature.



4.10.14 CELSIUS TEMPERATURE

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

The student will be able to...

3.10.14

master all I.O.'s in the module:

read and demonstrate temperature using a ribbon thermometer at intervals of 2°C and 1°C above zero.

identify:

boiling temperature of water as 100°C
freezing temperature of water as 0°C
body temperature as 37°C.

NEW I.O.'s

The student will be able to...

4.10.14.01

take a reading (above zero) on a thermometer.

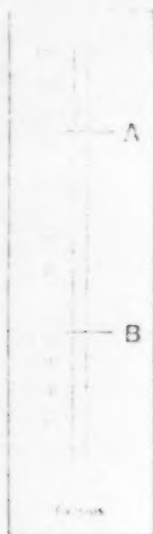
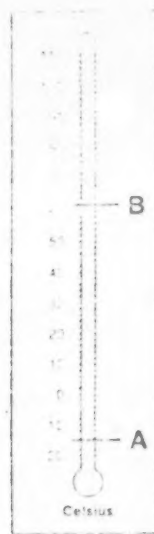
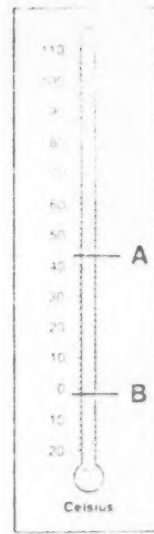
4.10.14.02

read and demonstrate temperature using a ribbon thermometer at intervals of 10°C below zero.

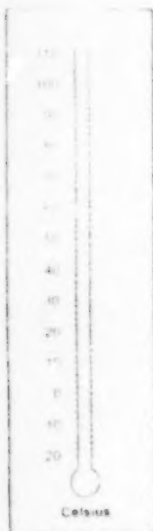
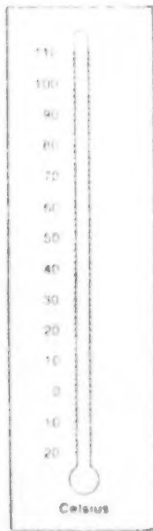
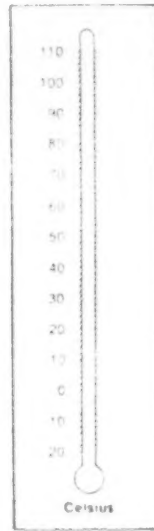
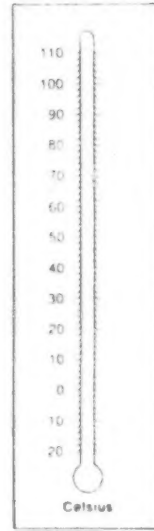
- 4.10.14.03 read and demonstrate temperature
using a ribbon thermometer at intervals
of 5°C below zero (-5°C)
- 4.10.14.04 read and demonstrate temperature using
a ribbon thermometer at intervals of
2°C, below zero. (-5°C)
- 4.10.14.05 read and demonstrate temperature using
a ribbon thermometer at intervals of
1°C, below zero. (-5°C)
- 4.10.14.06 identify approximate temperatures
of recognizable conditions.
e.g., you are sick at 40°C
- 4.10.14.07 solve story problems related to the
above I.O.'s.

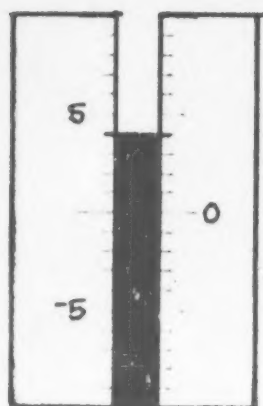
TEMPERATURE

I. What temperatures are shown on each thermometer?

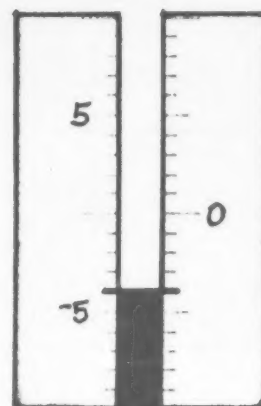
1. A
B2. A
B3. A
B4. A
B

II. Fill in the center line to show the temperature written below each thermometer.

1. -12°C 2. -6°C 3. -4°C 4. -20°C

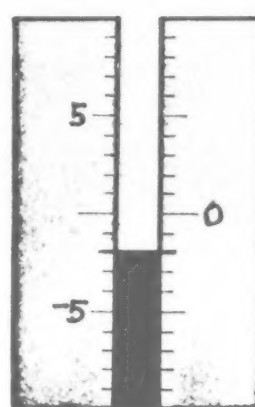
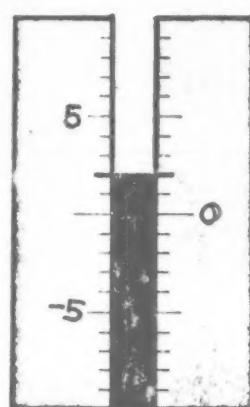
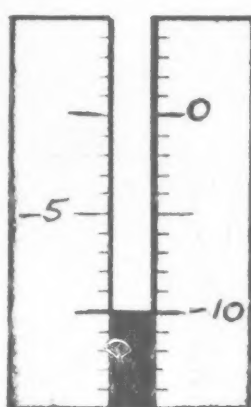
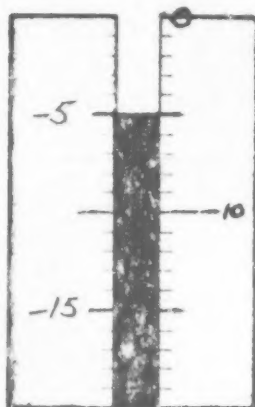


4 degrees above zero
We can write: 4° .



4 degrees below zero
We can write: -4° .

Write the temperature.



Which is warmest?

-10°

0°

-20°

50°

Which is coldest?

-10°

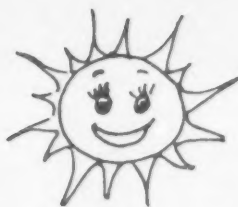
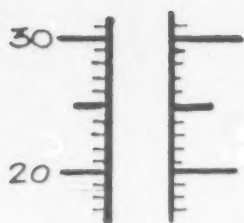
0°

94

-20°

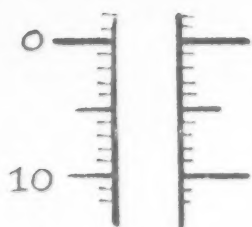
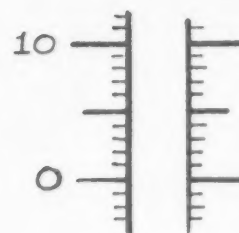
50°

COLOR ME CELSIUS



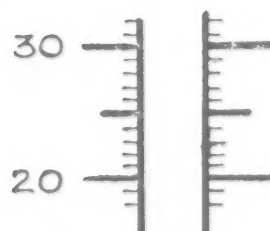
IT IS SUNNY AND
WARM. WEAR LIGHT
CLOTHING. IT IS
30° C.

IT IS CRISP
AND COOL. WEAR
A JACKET. IT IS
9° C.



IT IS SNOWING.
MY NOSE IS COLD.
IT IS - 7° C.

IT IS VERY
COMFORTABLE
INSIDE MY
HOUSE. IT IS
22° C.



• TEMPERATURE CHART

for the week of _____

DAY 

TIME  TEMP. 

MON.

	°C
--	----

• TUES.

	°C
--	----

WED.

	°C
--	----

THURS.

	°C
--	----

• FRI.

	°C
--	----

5.10.14 CELSIUS TEMPERATURE

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

The student will be able to...

4.10.14

master all I.O.'s in the module:

take a reading (above zero) on
a thermometer.

read and demonstrate temperature
using a ribbon thermometer at
intervals of 10°C, 5°C, 2°C and 1°C,
below zero.

identify approximate temperatures of
recognizable conditions.

NEW I.O.'s

The student will be able to...

5.10.14.01

take a reading (below zero) on a
thermometer.

5.10.14.02

solve problems related to Celsius
temperature.

Instructions to Teacher

TEMPERATURE

This lab sheet is the first of three designed to provide experience with the Celsius scale in particular and some interesting aspects of heat and temperature in general .

GENERAL OBJECTIVES

1. Provide the student with strong visual references which will reinforce his "feel" for different temperatures.
2. Take advantage of the use of the temperature scale to give experience with use of negative numbers in a natural context.
3. Provide a few simple experiments to familiarize the student with the thermometer through actual handling and use.

COMMENTS:

Students seem to have very little difficulty with the use of negative numbers in a temperature setting. They can see that the minus sign shows how far below 0. The concept of up and down is well- ingrained, much more so that left and right, so that a vertical number line is considerably easier for students to understand and use than a horizontal one.

Do not make an abstract or form point of negative-number manipulation. Simply encourage your students to think of "how far between the numbers on the scale " to answer the questions.

FURTHER ACTIVITIES :

You can set up a daily temperature chart, keeping records over a period of time, with different students taking readings on a regular basis.- You might want both morning and mid-day readings outdoors for your private weather bureau. In this way you will gradually build up weather data which you can use for student practice in various kinds of problems which refer directly to their weather activities.

You can explain to your students how "humidity" is measured by relating "wet-bulb" and "dry-bulb" readings if you have the students perform the following simple experiment. Place the thermometer outdoors on a table; give it time to stabilize; then read the temperature. Then put a few drops of water (at the same temperature as the air) on the bulb, wait a few moments for the reading to stabilize, and record your wet-bulb reading. It will be a different (lower), and the lower the humidity the more difference, in general. (Other factors also come into play; what is really involved is speed of evaporation)

°C { Celsius }

TEMPERATURE

How does a Thermometer Work?

A thermometer like the one in your kit works because the liquid in the tube *expands* (its volume gets bigger, so it takes up more room) when it gets warmer. That forces it *up* in the tube.

When it is colder, the volume of the liquid shrinks, so it doesn't reach as high in the tube.

Do Some Experiments

1. Hold the thermometer like this until the liquid stops rising.

What does it read? _____ °C

("Normal body temperature" is higher because it usually is measured under your tongue.)



2. On a clear sunny day, measure the outdoor temperature. Leave the thermometer in a given place for a few minutes before you take a reading.

In the shade _____ °C

In the sun _____ °C

(Time and date) _____

Thought Questions

1. Could you measure the temperature of a freezer with this thermometer? _____
2. If the thermometer used water in the tube, why couldn't you measure the temperature of the freezer? _____

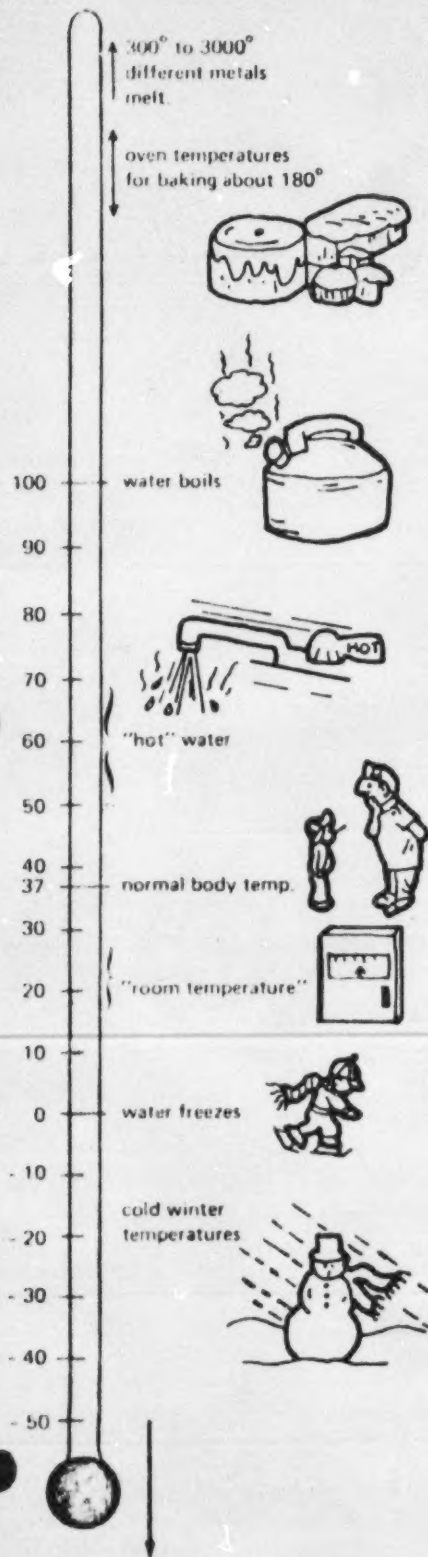
Here are some temperature readings taken in Omaha, Nebraska.

Date	High (°C)	Low (°C)	
Jan. 1	3°	-8°	(record low for Jan. = -35°)
Jan. 2	6°	-7°	
Jan. 3	-4°	-12°	

July 1	31°	20°	(record high for July = 45°)
July 2	35°	26°	
July 3	38°	29°	

What is the difference between the lowest temperature ever recorded in Omaha (-35°C) and the record high (45°C)? _____

What was the largest *daily* range (difference between high and low temperatures on the same day) from Jan. 1 to 3? _____ from July 1 to 3? _____



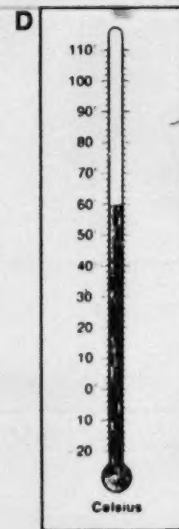
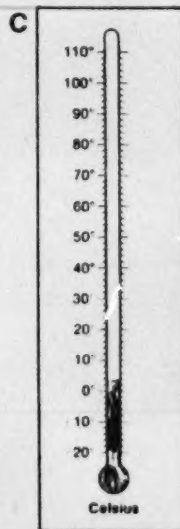
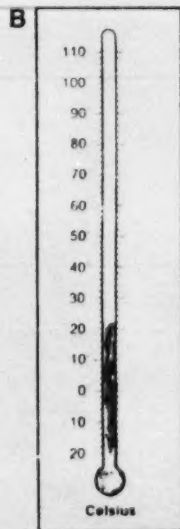
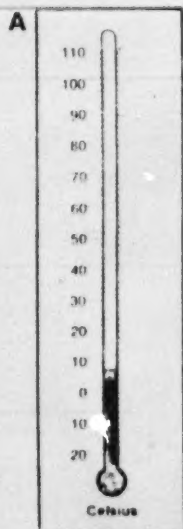
TEMPERATURE

I. Circle the best answer to complete the following sentences.

1. Your normal body temperature is about 37°C . You have a cold and are running a slight fever. Your temperature is about 5°C 39°C 101°C .
2. A cup of hot cocoa is just right for drinking. Its temperature is about 71°C 100°C -2°C .
3. You take ice cream from the freezer. You eat it right away. The temperature of the ice cream is about 40°C 62°C -5°C .
4. Some tomato sauce has been bubbling in a pan on the stove. You take the sauce from the pan and put it on some macaroni. When you eat it, the temperature of the sauce is about 80°C 40°C 10°C .

II. Match each item to the thermometer that shows what the temperature for each might be. Write on the line the letter of the thermometer you choose.

- | | | | |
|----------------------------------|---|-------------------|---------------------------------|
| 1. The air on a cool spring day. | 2. A hamburger right from the frying pan. | 3. Cold lemonade. | 4. Sherbert out of the freezer. |
|----------------------------------|---|-------------------|---------------------------------|



6.10.14 CELSIUS TEMPERATURE

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

The student will be able to...

5.10.14

master all I.O.'s in the module:

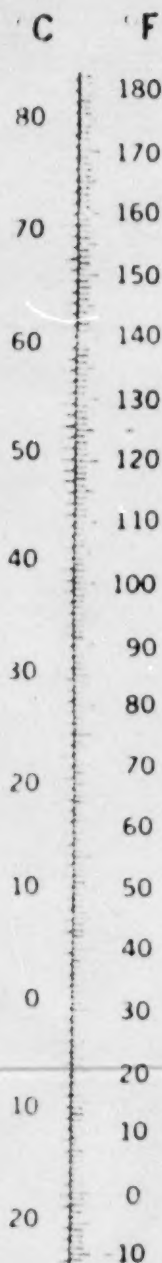
solve story problems related to
Celsius temperature.

NEW I.O.'s

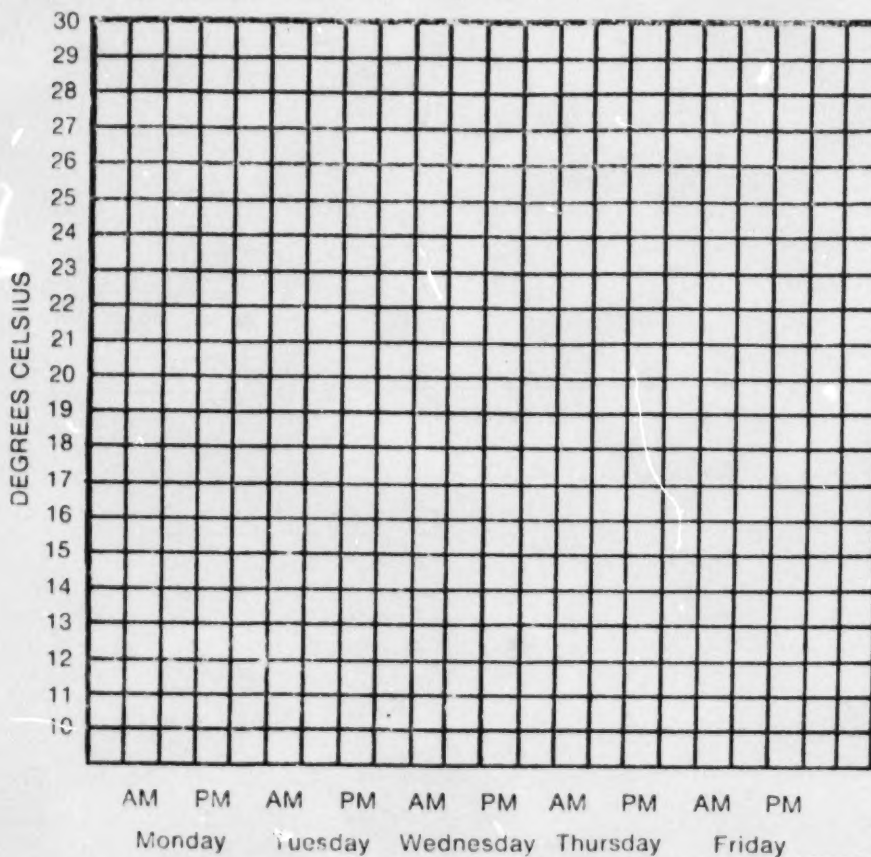
The student will be able to...

6.10.14.01

solve story problems related to
Celsius temperature, above and below
zero.



On the following chart, record the temperatures in the morning and in the afternoon for one school week. Record the temperature, using the degree Celsius rather than the degree Fahrenheit. If you cannot get a Celsius thermometer, use the scale shown to change from the degree Fahrenheit to the degree Celsius.



Which day had the greatest change in temperature? _____

Which day had the smallest change? _____

What was the average temperature in the morning? _____ in the afternoon? _____

Let's Practice

Circle the best temperature for each of the following scenes.



-10°C, 5°C, 40°C



40°C, 60°C, 90°C



-20°C, 5°C, 20°C



39°C, 98.6°C, 103°C



70°C, 100°C, 40°C



15°C, 23°C, 35°C



100°C, 180°C, 350°C



50°C, 70°C, 120°C

The most noticeable instance of our change to the degree Celsius will come when the United States Weather Bureau begins giving the temperature in degrees Celsius. When this happens, will the winter morning temperature in Chicago be below zero more often than it is now? _____ Why or why not? _____

Match the following temperatures with the correct city for a typical day in January at 6 A.M.

_____	Minot, North Dakota	-45°C	-5°C
_____	Washington, D.C.	72°C	26°C
_____	San Francisco, California	-30°C	18°C
_____	Point Barrow, Alaska	60°C	
_____	Honolulu, Hawaii		

On the following weather map, record, for each city, what could be a Celsius temperature at 1:00 P.M. on July 4.



6.10.10 METRIC RELATIONSHIPS

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

The student will be able to...

5.10.13

master all I.O.'s in the module
identify a metric ton as 1000 kg.
identify 1000 mg as one gram.
add and subtract units of mass with
regrouping in kg and g.

NEW I.O.s

The student will be able to...

6.10.10.01

identify that one liter (1000 ml) of
water has the mass of one kilogram.

6.10.10.02

identify that one cubic centimeter
of water has the mass of one gram.

6.10.10.03

multiply metric units (meters, liters,
grams).

e.g., 275 g

$$\begin{array}{r} \times 17 \\ 3 \text{ kg } 675 \text{ g} \end{array}$$

6.10.10.04 divide metric units (meters, liters,
grams).

$$5\ 512\ \text{T} \div 8 = 689\ \text{kg}$$

6.10.10.05 solve story problems related to
the above I.O.'s.

VOLUME AND WEIGHT

The volume and weight of water have a special relationship.



Take the milk carton dm^3 ; and fill it with very cold water. The volume of the cube is _____ cm^3 . The liquid capacity is about _____. If you weigh this water, you will find that it is about 1 kg. The symbol $\approx$ means "is about."

$$1 \text{ cm}^3 \approx 1 \text{ ml}$$

$$1 \text{ ml of water} \approx 1 \text{ g}$$

$$1 \text{ cm}^3 \text{ of water} \approx 1 \text{ g}$$

$$0.001 \text{ kg} = 1 \text{ g}$$

$$1000 \text{ cm}^3 \approx 1 \text{ l}$$

$$1000 \text{ cm}^3 \text{ of water} \approx 1 \text{ kg}$$

$$1 \text{ l of water} \approx 1 \text{ kg}$$

Use the information given above. Complete these statements.

22 cm^3 of water weighs about _____ g

18.3 l of water weighs about _____ kg

260 ml of water weighs about _____ g

7500 ml of water weighs about _____ kg

15.2 l of water weighs about _____ g

1 cm^3 of water weighs about _____ kg

5280 cm^3 of water weighs about _____ kg

1000 cm^3 of water weighs about _____ kg

625 g of water $\approx$ _____ l

7.52 g of water $\approx$ _____ ml

952 kg of water $\approx$ _____ l

7 g of water $\approx$ _____ l

32 kg of water $\approx$ _____ ml

5280 kg of water $\approx$ _____ l

0.4 g of water $\approx$ _____ ml

10 kg of water $\approx$ _____ l

Multiplying

name _____

Complete each multiplication.

1.
$$\begin{array}{r} 25\text{g} \\ \times 6 \\ \hline \end{array}$$

2.
$$\begin{array}{r} 74\text{kg} \\ \times 2 \\ \hline \end{array}$$

3.
$$\begin{array}{r} 47\text{m} \\ \times 8 \\ \hline \end{array}$$

4.
$$\begin{array}{r} 94\text{dm} \\ \times 7 \\ \hline \end{array}$$

5.
$$\begin{array}{r} 135\text{l} \\ \times 4 \\ \hline \end{array}$$

6.
$$\begin{array}{r} 329\text{kl} \\ \times 3 \\ \hline \end{array}$$

7.
$$\begin{array}{r} 450\text{cm} \\ \times 2 \\ \hline \end{array}$$

8.
$$\begin{array}{r} 769 \\ \times 6 \\ \hline \end{array}$$

Multiply.

9.
$$\begin{array}{r} 14\text{dam} \\ \times 2 \\ \hline \end{array}$$

10.
$$\begin{array}{r} 21\text{kg} \\ \times 4 \\ \hline \end{array}$$

11.
$$\begin{array}{r} 143\text{mm} \\ \times 2 \\ \hline \end{array}$$

12.
$$\begin{array}{r} 122\text{l} \\ \times 4 \\ \hline \end{array}$$

13.
$$\begin{array}{r} 62\text{ml} \\ \times 3 \\ \hline \end{array}$$

14.
$$\begin{array}{r} 92\text{kl} \\ \times 7 \\ \hline \end{array}$$

15.
$$\begin{array}{r} 88\text{T} \\ \times 6 \\ \hline \end{array}$$

16.
$$\begin{array}{r} 242\text{dm} \\ \times 3 \\ \hline \end{array}$$

17.
$$\begin{array}{r} 918\text{hm} \\ \times 2 \\ \hline \end{array}$$

18.
$$\begin{array}{r} 37\text{cm} \\ \times 4 \\ \hline \end{array}$$

19.
$$\begin{array}{r} 570\text{mg} \\ \times 5 \\ \hline \end{array}$$

20.
$$\begin{array}{r} 312\text{ml} \\ \times 8 \\ \hline \end{array}$$

21.
$$\begin{array}{r} 69\text{T} \\ \times 9 \\ \hline \end{array}$$

22.
$$\begin{array}{r} 375\text{m} \\ \times 3 \\ \hline \end{array}$$

23.
$$\begin{array}{r} 680\text{l} \\ \times 7 \\ \hline \end{array}$$

24.
$$\begin{array}{r} 731\text{cm} \\ \times 5 \\ \hline \end{array}$$

Multiplying Two-digit Numbers

name _____

Multiply.

$$\begin{array}{r} 1. \quad 56 \text{ cm} \\ \times 23 \\ \hline \end{array}$$

$$\begin{array}{r} 2. \quad 92 \text{ g} \\ \times 16 \\ \hline \end{array}$$

$$\begin{array}{r} 3. \quad 83 \text{ l} \\ \times 65 \\ \hline \end{array}$$

$$\begin{array}{r} 4. \quad 25 \text{ kg} \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} 5. \quad 51 \text{ m} \\ \times 23 \\ \hline \end{array}$$

$$\begin{array}{r} 6. \quad 78 \text{ dam} \\ \times 17 \\ \hline \end{array}$$

$$\begin{array}{r} 7. \quad 63 \text{ hm} \\ \times 39 \\ \hline \end{array}$$

$$\begin{array}{r} 8. \quad 54 \text{ ml} \\ \times 97 \\ \hline \end{array}$$

$$\begin{array}{r} 9. \quad 37 \text{ mm} \\ \times 45 \\ \hline \end{array}$$

$$\begin{array}{r} 10. \quad 14 \text{ cm} \\ \times 86 \\ \hline \end{array}$$

$$\begin{array}{r} 11. \quad 66 \text{ g} \\ \times 24 \\ \hline \end{array}$$

$$\begin{array}{r} 12. \quad 49 \text{ dm} \\ \times 73 \\ \hline \end{array}$$

$$\begin{array}{r} 13. \quad 63 \text{ dg} \\ \times 35 \\ \hline \end{array}$$

$$\begin{array}{r} 14. \quad 81 \text{ km} \\ \times 53 \\ \hline \end{array}$$

$$\begin{array}{r} 15. \quad 95 \text{ T} \\ \times 46 \\ \hline \end{array}$$

$$\begin{array}{r} 16. \quad 28 \text{ mm} \\ \times 84 \\ \hline \end{array}$$

$$\begin{array}{r} 17. \quad 44 \text{ T} \\ \times 19 \\ \hline \end{array}$$

$$\begin{array}{r} 18. \quad 52 \text{ cm} \\ \times 98 \\ \hline \end{array}$$

Divide.

1. $2 \overline{)55} \text{kl}$

2. $5 \overline{)97} \text{dm}$

3. $6 \overline{)131} \text{g}$

4. $8 \overline{)264} \text{m}$

5. $7 \overline{)384} \text{mm}$

6. $4 \overline{)167} \text{cm}$

7. $5 \overline{)426} \text{dam}$

8. $3 \overline{)216} \text{hg}$

9. $6 \overline{)405} \text{T}$

10. $9 \overline{)640} \text{kg}$

11. $7 \overline{)347} \text{g}$

12. $8 \overline{)511} \text{l}$

Divide.

1. $13 \overline{)109} \text{ g}$

2. $24 \overline{)97} \text{ m}$

3. $70 \overline{)522} \text{ l}$

4. $52 \overline{)416} \text{ cm}$

5. $31 \overline{)164} \text{ m}$

6. $93 \overline{)880} \text{ km}$

7. $65 \overline{)441} \text{ ml}$

8. $48 \overline{)195} \text{ T}$

9. $92 \overline{)222} \text{ dg}$

10. $59 \overline{)531} \text{ dag}$

11. $27 \overline{)149} \text{ mm}$

12. $36 \overline{)258} \text{ cm}$

13. $6243 \text{ g} \div 9 =$

14. $321 \text{ m} \div 4 =$

15. $6204 \text{ g} \div 2 =$

CROSS-NUMERAL PUZZLE

1	2		3	4
5		6	7	
		8		9
10	11		12	13
14		15	16	

Complete the diagram by finding the answers to the problems below. One digit per square.

Across

1. $7 \text{ mm} \times 5 = \underline{\hspace{1cm}} \text{ mm}$
3. $9 \text{ m} \times 2 = \underline{\hspace{1cm}} \text{ m}$
5. $3 \text{ cm} \times 2 = \underline{\hspace{1cm}} \text{ cm}$
6. $12 \text{ dm} \times 2 = \underline{\hspace{1cm}} \text{ dm}$
8. $7 \text{ m} \times 1 = \underline{\hspace{1cm}} \text{ m}$
9. $3 \text{ cm} \times 1 = \underline{\hspace{1cm}} \text{ cm}$
10. $14 \text{ mm} \times 2 = \underline{\hspace{1cm}} \text{ mm}$
12. $5 \text{ dm} \times 5 = \underline{\hspace{1cm}} \text{ dm}$
14. $1 \text{ m} \times 1 = \underline{\hspace{1cm}} \text{ m}$
15. $5 \text{ dm} \times 4 = \underline{\hspace{1cm}} \text{ dm}$

Down

1. $18 \text{ dm} \times 2 = \underline{\hspace{1cm}} \text{ dm}$
2. $1 \text{ cm} \times 5 = \underline{\hspace{1cm}} \text{ cm}$
3. $7 \text{ m} \times 2 = \underline{\hspace{1cm}} \text{ m}$
4. $8 \text{ cm} \times 1 = \underline{\hspace{1cm}} \text{ cm}$
6. $30 \text{ m} - 3 \text{ m} = \underline{\hspace{1cm}} \text{ m}$
9. $7 \text{ cm} \times 5 = \underline{\hspace{1cm}} \text{ cm}$
10. $20 \text{ km} + 1 \text{ km} = \underline{\hspace{1cm}} \text{ km}$
11. $4 \text{ m} \times 2 = \underline{\hspace{1cm}} \text{ m}$
12. $4 \text{ dm} \times 5 = \underline{\hspace{1cm}} \text{ dm}$
15. $2 \text{ cm} \times 1 = \underline{\hspace{1cm}} \text{ cm}$

CROSS-NUMERAL PUZZLE

1		2	3	
4	5		6	7
	8	9		10
11		12	13	
14	15		16	17

Complete the diagram by finding the answers to the problems below. One digit per space.

Across

1. $7 \text{ cm} + 0 \text{ cm} = \underline{\hspace{1cm}} \text{ cm}$
2. $6 \text{ dm} \times 3 = \underline{\hspace{1cm}} \text{ dm}$
4. $9 \text{ m} \times 5 = \underline{\hspace{1cm}} \text{ m}$
6. $8 \text{ cm} \times 3 = \underline{\hspace{1cm}} \text{ cm}$
8. $93 \text{ m} - 22 \text{ m} = \underline{\hspace{1cm}} \text{ m}$
10. $8 \text{ m} \times 0 = \underline{\hspace{1cm}} \text{ m}$
11. $3 \text{ m} \times 1 = \underline{\hspace{1cm}} \text{ m}$
12. $7 \text{ mm} \times 4 = \underline{\hspace{1cm}} \text{ mm}$
14. $8 \text{ cm} \times 3 = \underline{\hspace{1cm}} \text{ cm}$
16. $7 \text{ dm} \times 5 = \underline{\hspace{1cm}} \text{ dm}$

Down

1. $75 \text{ cm} - 1 \text{ cm} = \underline{\hspace{1cm}} \text{ cm}$
2. $1 \text{ m} \times 1 = \underline{\hspace{1cm}} \text{ m}$
3. $91 \text{ cm} - 9 \text{ cm} = \underline{\hspace{1cm}} \text{ cm}$
5. $78 \text{ m} + 10 \text{ m} - 31 \text{ m} = \underline{\hspace{1cm}} \text{ m}$
7. $8 \text{ cm} \times 5 = \underline{\hspace{1cm}} \text{ cm}$
9. $2 \text{ mm} \times 6 = \underline{\hspace{1cm}} \text{ mm}$
11. $8 \text{ cm} \times 4 = \underline{\hspace{1cm}} \text{ cm}$
13. $36 \text{ dm} + 43 \text{ dm} + 4 \text{ dm} = \underline{\hspace{1cm}} \text{ dm}$
15. $4 \text{ mm} \times 1 = \underline{\hspace{1cm}} \text{ mm}$
17. $1 \text{ dm} \times 5 = \underline{\hspace{1cm}} \text{ dm}$

PRACTICE WITH WEIGHT

Do the following:

1. John weighs 74 kg and his sister, Susan, weighs 56 kg. Find the difference in their weights. _____
2. The Smith's new baby weighs 3 kg. If she doubles her weight in six months, how much will she weigh? _____
3. Mrs. Brown bought 500 g of meat, 2 kg of potatoes, 300 g of tomatoes. What was the total weight of her purchase? (Use one unit in your answer.) _____
4. Jimmy's father has a truck that can carry 10 metric tons. How many kilograms is that? _____
5. Suppose a box of erasers weighs .024 kg and a box of chalk weighs 27 g. Which is heavier? _____ How much heavier is it in grams? _____ In kilograms? _____
6. Mother made a casserole using $\frac{1}{2}$ kg of hamburger and $\frac{1}{4}$ kg of sausage. If she served the casserole in four equal portions, how much did each person have in kilograms? (a) _____ grams? (b) _____
7. If meat costs \$2.40 a kg, how much could you buy for \$12.00? _____
8. If a farmer sold 4.5 tons of potatoes at 6 cents a kilogram, how much money did he receive? _____
9. If one kilogram of meat is enough for 10 people, how much meat is needed for 450? _____
10. A truck weighs 10,198 kg when loaded. If the empty weight of the truck is 5,648 kg, what is the weight of the load? _____
11. If a liquid weighs 0.8 as much as the same amount of water, what is the weight of 20 liters of it? _____ (Hint: 1 liter weighs _____ kilogram?)
12. If a container of coffee costs \$3.00 per kilogram, what would 500 grams cost? _____ (Hint: 500 grams = _____ kilograms?)

CAPACITY

If you take a cube which is 10 cm on a side (a cubic decimeter or dm^3) and fill it with water, it will hold exactly 1 liter. The liter is the basic unit of capacity. We commonly use the liter (l) and the milliliter (ml) as units of capacity. Yet because of the decimal nature of the metric system, other units exist.

A. Show the correct symbol for the units of capacity by attaching the metric prefixes to l, the symbol for liter.

kiloliter	hectoliter	decaliter	liter
1. _____	2. _____	3. _____	4. _____
deciliter	centiliter	milliliter	
5. _____	6. _____	7. _____	

B. Do the following:

1. If milk costs 30¢ a liter, how much will 2 liters cost? _____
 2. What is the capacity (not volume) of a hollow block that measures 10 cm by 10 cm by 10 cm? _____
 3. Since $1,000 \text{ ml} = 1 \text{ liter}$; $15 \text{ l} =$ _____ ml.
 4. Since $1,000 \text{ dm}^3$ are contained within 1 m^3 , a m^3 will hold _____ liters.
 5. How many liters of gasoline will be used on a trip of 3840 km if the car uses 1 liter to go 8 km? _____
 6. If a glass of lemonade contained 250 ml and cost 15¢, how much would a liter of it cost? _____
 7. If a man drives 500 km and uses 40 liters of gasoline, we can say that he traveled _____ km per liter of gasoline.
 8. If gasoline costs 20¢ a liter, how much will 25 liters cost? _____
- Remember: all units of surface, volume, weight, and capacity are directly related to the meter.
9. One liter contains _____ dm^3 of water and weighs _____ kg.
 10. Ten liters contain _____ dm^3 of water and weigh _____ kg.
 11. 10 liters are equal to _____ dekaliter(s), dal.
 12. 10 kilograms are equal to _____ grams.
 13. Five kilograms of water would fill _____ liters.
 14. Seven cubic decimeters would fill _____ liters.
 15. Ten cubic decimeters of water should weigh _____ kilograms, or _____ grams.

PROBLEMS IN MEASURING AREA

Do the following using the formula $A = l \times w$

1. The Folds family wants to carpet their living room. The room is 5 m wide and 7 m long. They must buy _____ m^2 of carpet. What will this carpet cost at \$10.00 per m^2 ? _____
2. The Jones's house was on a lot 30 m by 60 m. How many square meters did their lot contain? _____
3. A room is 10 m by 1,000 cm. What is its area? _____
4. If one liter of paint will cover $10 m^2$ of a wall, how many liters will you need to paint a room 4 m wide by 5 m long by 3.5 m high? _____
5. How many cm^2 are in a m^2 ? _____
6. Mr. Taylor's garden is 10 m wide and 20 m long. What is the area of Mr. Taylor's garden? _____
7. If a rectangle has sides measuring 6 cm by 30 cm, what is its area in cm^2 ? _____ In m^2 ? _____
8. Find the area of a square whose perimeter is 80 cm. _____
9. A rectangular picture is 36 cm long and 16 cm wide. Find its area. _____
10. A garden 120 m by 15 m is near a playing field 120 m long and 150 m wide. What is their difference in area? _____
11. If a liter of paint will cover $20 m^2$ of wall space, how many liters of paint would be needed to paint four walls of a room 10 m long, 8 m wide, and 3 m high? _____
12. Find the area of a rectangle 37 cm long and 14 cm wide. _____
13. If $1 m =$ _____ cm
Then $1 m^2 =$ _____ $cm \times$ _____ cm
or _____ cm^2
14. If $1 m^2 =$ _____ cm^2
Then $4 m^2 = 4 \times$ _____ cm^2 or _____ cm^2
And $.5 m^2 =$ _____ $cm^2 \div 2$ or _____ cm^2
And $4.5 m^2 =$ _____ cm^2

MIXED PRACTICE

Do the following:

1. If I fill a bottle with 2 liters of water, about how much will the water weigh? _____
2. If 1 kg of hamburger costs \$0.90, how many kg could you buy for \$7.20? _____
3. It is 24 km from Randall to Beloit and 15 km from Beloit to Glasco. It is 33 km from Glasco back to Randall. How many liters of gasoline will we use on such a trip if our car uses 1 liter to go 6 km?

4. Mr. White has a metal tank on his truck to be used for handling water. The tank is 5 m long, 3 m wide, and 1 m high. About how much does the water in the tank weigh when it is full? _____
Remember: $1 \text{ m}^3 = \text{one metric ton or } 1,000,000 \text{ grams}$
5. If a container has a capacity of 13 liters of water, what would be the approximate weight of the water when it is full? _____
6. If a container had a capacity of 28 liters, what would be its volume? _____
7. If one cm^3 of oil weighs 0.91 g, how much would one liter weigh?

8. If a liter of concrete weighs 3 kg, how much does a cubic meter weigh? _____
9. The average weight of 15 bags of flour is 50 kg per bag. If the weight of an empty bag is 55 grams, find the total weight of the flour. _____
10. If a car uses 1 liter of gasoline to go 12 km, how much gasoline does it need to go 225 km? _____
11. If a sack of sugar weighs 50 kg, how many bags, each weighing 0.5 kg, can we get from it? How much more sugar do we need if we want 150 such bags altogether? (a) _____ (b) _____
12. A certain company advertises a new washer. It uses 20 liters of water for a regular load and 16 liters for a small load. How much more water does it use for a regular load than it uses for a small load? _____
13. A soft drink bottle holds 500 milliliters. What part of a liter is that? _____

6.10.11 METRIC CONVERSIONS

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

4.10.11

The student will be able to ...

recognize the equivalency of
standard units of metric measure.

5.10.09

identify the root words and prefixes
for metric measures.

5.10.10

write any standard metric unit in
equivalent fraction and decimal
notation.

$$\text{e.g. } 1 \text{ cm} = \frac{1}{100\text{m}} = 0.01\text{m}$$

NEW I.O.'s

6.10.11.01

The student will be able to ...

convert larger metric units to
equivalent smaller metric units
by multiplying.

$$\begin{aligned}\text{e.g. } 2 \text{ kg} &= (2 \times 1000\text{g}) = 2000\text{g} \\ 3 \text{ m} &= (3 \times 100\text{cm}) = 300\text{cm} \\ 2 \text{ cl} &= (2 \times 10 \text{ ml}) = 20\text{ml}\end{aligned}$$

6.10.11.02

convert smaller metric units to
equivalent larger metric units
by dividing.

$$\begin{aligned}\text{e.g. } 4000\text{g} &= (4000 \div 1000) = 4 \text{ kg} \\ 600\text{cm} &= (600 \div 100) = 6\text{m} \\ 70\text{ml} &= (70 \div 10) = 7\text{cl}\end{aligned}$$

6.10.11 METRIC CONVERSIONS

NEW I.O.'s, CONTINUED

6.10.11.03 convert larger metric units to
equivalent smaller metric units
by moving the decimal point to
the right, indicating multiplication
by a power of 10.

e.g. $3.0\text{m} = 30\text{dm}$
 $6.281 = 62.8\text{dl} = 628\text{cl}$
 $83.4\text{g} = 834\text{dg} = 8340\text{cg}.$

6.10.11.04 convert smaller metric units to
equivalent larger metric units
by moving the decimal point to
the left indicating division by
a power of 10.

e.g. $324\text{cm} = 32.4\text{dm} = 3.24\text{m}$
 $6708\text{ml} = 670.8\text{cl} = 67.08\text{dl} = 6.708\text{L}$
 $8768\text{g} = 876.8\text{dag} = 87.68\text{hg} = 8.768\text{kg}$

RENAME ANOTHER WAY

cm	mm
3	2
2	12

RENAME

1 less cm
↓
10 more mm



3 cm 2 mm is renamed as 2 cm 12 mm

cm	mm
6	4

RENAME

1 less cm
↓
10 more mm

6 cm 4 mm is renamed
as

cm	mm
2	7

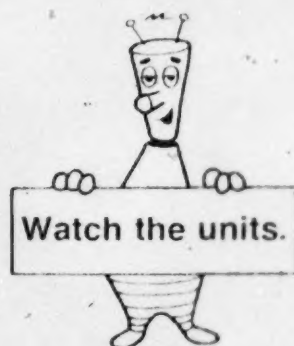
RENAME

2 cm 7 mm is renamed
as

cm	mm
8	6

RENAME

8 cm 6 mm is renamed
as



1 dm = 10 cm

dm	cm
4	9

RENAME

4 dm 9 cm is renamed
as

1 hm = 100 m

hm	m
7	4

RENAME

7 hm 4 m is renamed
as

1 m = 100 cm

m	cm
3	36

RENAME

3 m 36 cm is renamed
as

1 m = 100 cm

m	cm
8	23

RENAME

8 m 23 cm is renamed
as

1 km = 1000 m

km	m
5	312

RENAME

5 km 312 m is renamed
as

RENAMING IN ADDITION

$$1 \text{ cm} = 10 \text{ mm}$$

cm	mm
	12
1	2

RENAME

Two names for
the same
measure



12 mm is renamed as 1 cm 2 mm

$$1 \text{ cm} = 10 \text{ mm}$$

cm	mm
	19

RENAME

19 mm is renamed as

$$1 \text{ dm} = 10 \text{ cm}$$

dm	cm
	23

RENAME

23 cm is renamed as

$$1 \text{ m} = 10 \text{ dm}$$

m	dm
	52

RENAME

52 dm is renamed as



Look carefully
before you
rename

$$1 \text{ m} = 100 \text{ cm}$$

m	cm
	114
1	14

RENAME

114 cm is renamed as 1 m 14 cm

$$1 \text{ m} = 100 \text{ cm}$$

m	cm
	232

RENAME

232 m is renamed as

$$1 \text{ km} = 1000 \text{ m}$$

km	m
	1142

RENAME

142 km is renamed as

$$1 \text{ hm} = 100 \text{ m}$$

hm	m
	856

RENAME

856 hm is renamed as



Fill in the rest of the chart. Then circle the correct answers to the problems at the right.

<i>l</i> litre	<i>ml</i> milli- litre
1.389	1389
	3021
	8120
0.435	
0.29	
0.6	
	405
	39
11.632	
	7004
4.111	
10.8	
	22
0.004	

$$1829 \text{ ml} \begin{cases} \rightarrow 1.829 \text{ l} \\ \rightarrow 18.29 \text{ l} \\ \rightarrow 182.9 \text{ l} \end{cases}$$

$$3.26 \text{ l} \begin{cases} \rightarrow 326 \text{ ml} \\ \rightarrow 0.326 \text{ ml} \\ \rightarrow 3260 \text{ ml} \end{cases}$$

$$299 \text{ ml} \begin{cases} \rightarrow 29.9 \text{ l} \\ \rightarrow 0.299 \text{ l} \\ \rightarrow 2.99 \text{ l} \end{cases}$$

$$63 \text{ ml} \begin{cases} \rightarrow 630 \text{ l} \\ \rightarrow 0.63 \text{ l} \\ \rightarrow 0.063 \text{ l} \end{cases}$$

$$4.4 \text{ l} \begin{cases} \rightarrow 440 \text{ ml} \\ \rightarrow 4400 \text{ ml} \\ \rightarrow 44 \text{ ml} \end{cases}$$

$$7.333 \text{ l} \begin{cases} \rightarrow 73.33 \text{ ml} \\ \rightarrow 7333 \text{ ml} \\ \rightarrow 733.3 \text{ ml} \end{cases}$$

$$8.56 \text{ l} \begin{cases} \rightarrow 8560 \text{ ml} \\ \rightarrow 85.6 \text{ ml} \\ \rightarrow 856 \text{ ml} \end{cases}$$

$$2 \text{ ml} \begin{cases} \rightarrow 2000 \text{ l} \\ \rightarrow 0.002 \text{ l} \\ \rightarrow 0.2 \text{ l} \end{cases}$$

$$10.014 \text{ l} \begin{cases} \rightarrow 10,014 \text{ ml} \\ \rightarrow 100.14 \text{ ml} \\ \rightarrow 1001.4 \text{ ml} \end{cases}$$

$$6 \text{ l} \begin{cases} \rightarrow 600 \text{ ml} \\ \rightarrow 60 \text{ ml} \\ \rightarrow 6000 \text{ ml} \end{cases}$$

$$562 \text{ ml} \begin{cases} \rightarrow 0.562 \text{ l} \\ \rightarrow 5.62 \text{ l} \\ \rightarrow 56.2 \text{ l} \end{cases}$$

$$3018 \text{ ml} \begin{cases} \rightarrow 0.3018 \text{ l} \\ \rightarrow 30180 \text{ l} \\ \rightarrow 3.018 \text{ l} \end{cases}$$

FILL IN THE CORRECT ANSWERS.

$$6.111 \text{ l} = \text{_____ ml} \quad \text{_____ l} = 5 \text{ ml}$$

$$45 \text{ ml} = \text{_____ l} \quad 21,389 \text{ ml} = \text{_____ l}$$

$$\text{_____ ml} = 1.1 \text{ l} \quad \text{_____ ml} = 8.4 \text{ l}$$

$$\text{_____ l} = 291 \text{ ml} \quad 0.006 \text{ l} = \text{_____ ml}$$

Complete each table.

1.

Kilometers	1	2	3	4	5
Meters					

2.

Meters	1	2	3	4	5
Centimeters					

3.

Kilograms	1	2	3	4	5
Grams					

Give the missing numbers.

4. 9 meters = _____ centimeters

5. 20 meters = _____ centimeters

6. 133 meters = _____ centimeters

7. 376 meters = _____ centimeters

8. 6 kilometers = _____ meters

9. 15 kilometers = _____ meters

10. 128 kilometers = _____ meters

11. 169 kilometers = _____ meters

12. 9 kilograms = _____ grams

13. 12 kilograms = _____ grams

14. 137 kilograms = _____ grams

15. 280 kilograms = _____ grams

Circle the best answer.

16. The width of a TV screen is about

55 centimeters.
55 meters.
55 kilometers.

17. The height of a 10-year-old is about

140 centimeters.
140 meters.
140 kilometers.

18. The distance from first to second base on a baseball field is about

28 centimeters.
28 meters.
28 kilometers.

19. Gail's cat weighs about

5 grams.
5 kilograms.

20. The distance from Valley City to New London is about

175 centimeters.
175 meters.
175 kilometers.

21. A box of breakfast cereal weighs about

300 grams.
300 kilograms.

Propelling Puzzle

★ Work the problems. On the next page, connect your answers in order. ★

1) $3 \text{ g} = \underline{\hspace{2cm}} \text{ mg}$

2) $1.531 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

3) $35 \text{ mg} = \underline{\hspace{2cm}} \text{ g}$

4) $0.019 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

5) $3.72 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

6) $3 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

7) $7300 \text{ mg} = \underline{\hspace{2cm}} \text{ g}$

8) $456 \text{ g} = \underline{\hspace{2cm}} \text{ kg}$

9) $0.37 \text{ g} = \underline{\hspace{2cm}} \text{ mg}$

10) $45 \text{ g} = \underline{\hspace{2cm}} \text{ kg}$

11) $8 \text{ mg} = \underline{\hspace{2cm}} \text{ g}$

12) $12 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

13) $299 \text{ mg} = \underline{\hspace{2cm}} \text{ g}$

14) $6209 \text{ g} = \underline{\hspace{2cm}} \text{ kg}$

15) $0.007 \text{ g} = \underline{\hspace{2cm}} \text{ mg}$

16) $22 \text{ g} = \underline{\hspace{2cm}} \text{ kg}$

17) $0.51 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

18) $9.1 \text{ g} = \underline{\hspace{2cm}} \text{ mg}$

19) $647 \text{ mg} = \underline{\hspace{2cm}} \text{ g}$

20) $9 \text{ g} = \underline{\hspace{2cm}} \text{ kg}$

21) $2.08 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

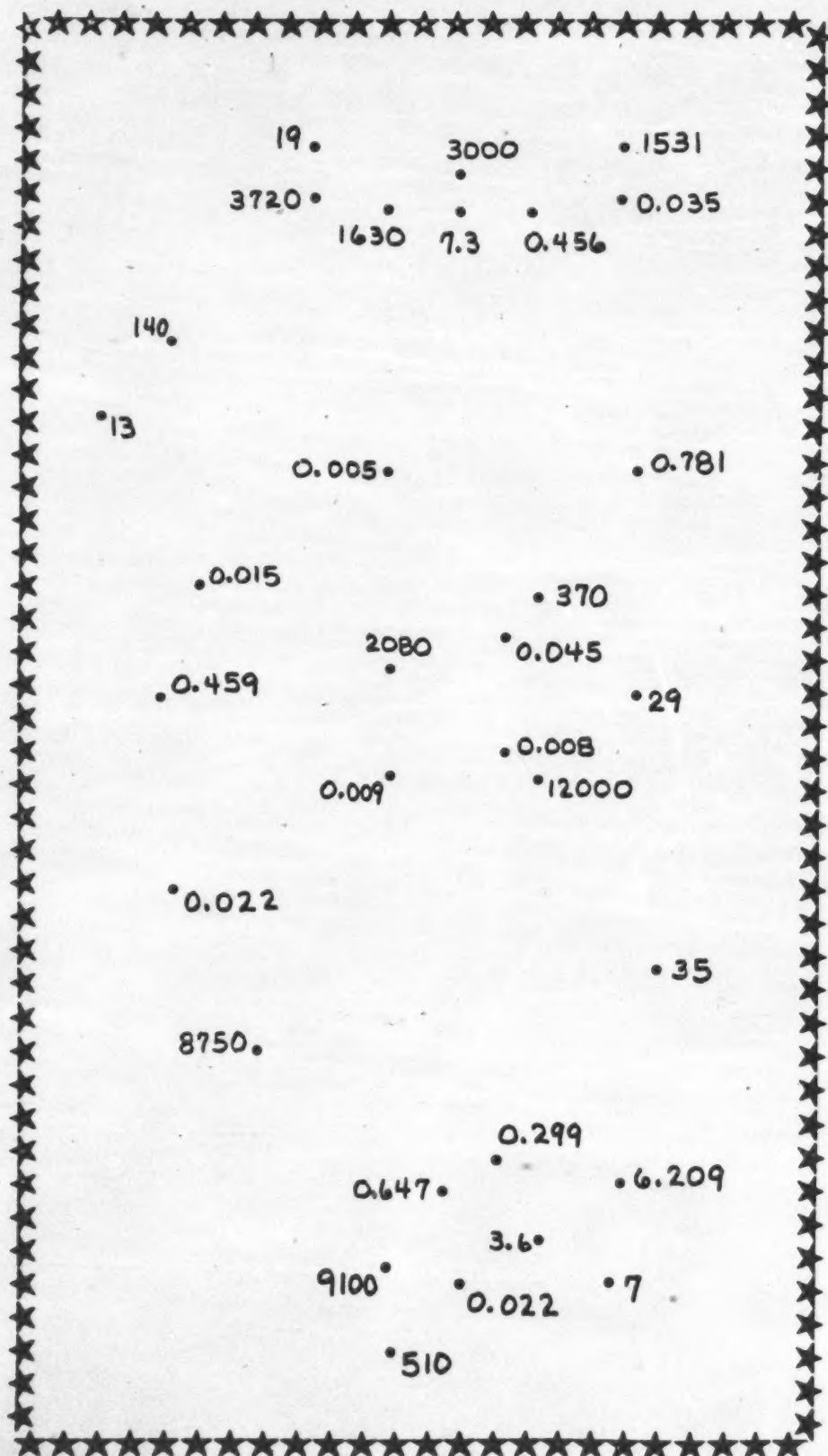
22) $22 \text{ mg} = \underline{\hspace{2cm}} \text{ g}$

23) $459 \text{ g} = \underline{\hspace{2cm}} \text{ kg}$

24) $5 \text{ mg} = \underline{\hspace{2cm}} \text{ g}$

25) $1.63 \text{ g} = \underline{\hspace{2cm}} \text{ mg}$

26) $7300 \text{ g} = \underline{\hspace{2cm}} \text{ kg}$



Working with Units of Length

$$1000 \text{ m} = 1 \text{ km}$$

$$100 \text{ cm} = 1 \text{ m}$$

$$1000 \text{ mm} = 1 \text{ m}$$

1. Complete each of the following.

a. $35 \text{ m} = \text{_____ cm} = \text{_____ mm}$

b. $48 \text{ mm} = \text{_____ cm} = \text{_____ m}$

c. $16 \text{ mm} = \text{_____ m} = \text{_____ cm}$

d. $25 \text{ km} = \text{_____ m} = \text{_____ cm}$

e. $15 \text{ cm} = \text{_____ m} = \text{_____ mm}$

f. $9.5 \text{ m} = \text{_____ cm} = \text{_____ km}$

g. $7.4 \text{ km} = \text{_____ m} = \text{_____ cm}$

h. $6.2 \text{ m} = \text{_____ mm} = \text{_____ km}$

i. $12.8 \text{ cm} = \text{_____ m} = \text{_____ mm}$

j. $89.5 \text{ mm} = \text{_____ m} = \text{_____ cm}$

k. $7 \text{ m } 45 \text{ cm} = \text{_____ m} = \text{_____ cm}$

l. $6 \text{ m } 20 \text{ cm} = \text{_____ m} = \text{_____ cm}$

m. $2 \text{ m } 13 \text{ cm } 5 \text{ mm} = \text{_____ m} = \text{_____ cm}$

n. $8 \text{ km } 45 \text{ m} = \text{_____ km} = \text{_____ m}$

o. $9 \text{ km } 3 \text{ m } 45 \text{ cm} = \text{_____ km} = \text{_____ m}$

2. Complete each of the following by writing the correct symbol $>$, $<$, or $=$.

a. $1 \text{ m} \text{ _____ } 50 \text{ cm}$

b. $150 \text{ cm} \text{ _____ } 1 \text{ m}$

c. $240 \text{ mm} \text{ _____ } 24 \text{ cm}$

d. $38 \text{ m} \text{ _____ } 0.38 \text{ km}$

e. $325 \text{ cm} \text{ _____ } 3.025 \text{ m}$

f. $60.5 \text{ cm} \text{ _____ } 605 \text{ mm}$

g. $50 \text{ cm} \text{ _____ } 0.5 \text{ m}$

h. $18 \text{ km} \text{ _____ } 1800 \text{ m}$

i. $62 \text{ cm} \text{ _____ } 602 \text{ mm}$

j. $10.5 \text{ m} \text{ _____ } 1050 \text{ cm}$